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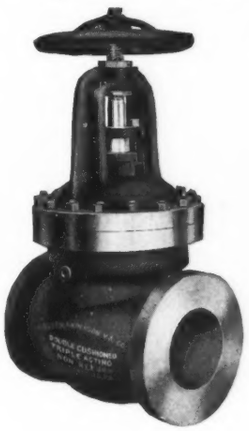

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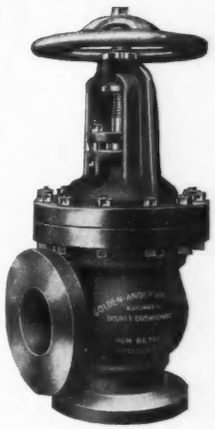

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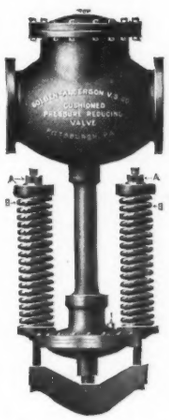

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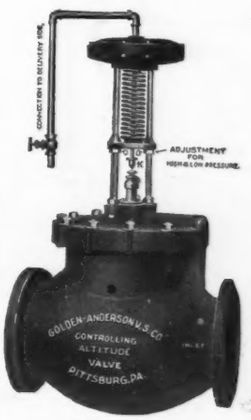

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Engineering and Mining Journal

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Amenities of Bolivian Mining

By Mark R. Lamb*

SYNOPSIS—Tin mine at Llallagua at an altitude of 13,000 ft. pays its staff double salaries on account of the altitude. No one but native-born and trained can wield a single jack at this altitude. Native Bolivians are improvident, and the rising generation is absolutely neglected, primitive mining and milling methods slowly giving way to modern machinery. The tin produced has been shipped to England without cable quotations and has been sold there on the market. The miner has to take what he can get for his product when it arrives on the English market.

It is the small mines that are being worked in Chile and Bolivia by individuals or small companies that are attractive. Most of them are owned by Chilean capital, the foreigner rarely having any part.

The Bolivian mine around which the most exciting stock-exchange battle has raged during the past few years is the Llallagua (pronounced yah-yah-guah). This is a tin mine. It has a consistent record of big production, excellent management and violent fluctuations in share values. Until recently the mine supported a very expensive lawsuit, but good counsel and a wise adjuster have succeeded in bringing the dispute to an end, with the result that it and its former antagonist, Sr. Simon Patiño, will be able to work for dividends instead of to provide for fees.

The mines are at an elevation of 13,000 ft. above sea level. This feature alone doubles the salaries of the staff. It is a long day's horseback ride from the railway station at Challapata, and the guide passes the time pleasantly by pointing out where the messenger carrying the pay was shot, where the Turk peddler was robbed and killed, and similar assuring incidents.

On the way out to the mine droves of llamas are passed carrying out supplies and machinery or bringing in cargoes of tin concentrates. The llamas are not fed, so they pick up what they can while traveling. Their rate of progress is thus quite limited. They are not much larger than goats and not as strong as burros, so a 100-lb. load is a maximum. Nevertheless they freight at a lower rate than carts or mules can do, owing to the feed problem. On the high plateau region of Bolivia it takes, speaking conservatively, one llama or two burros or five mules to find a blade of grass per hour.

LA PAZ, BOLIVIA, A CAPITAL CITY IN THE MOUNTAINS. IN THE BACKGROUND IS ILLIMANI, THE HIGHEST MOUNTAIN IN THE WESTERN HEMISPHERE

The combination of llamas and Bolivian Indians is successful in transporting materials that are not easily injured, but it fails where brains are required of either. For example, cement is packed in suitable bags for llama transportation and arrives in good condition during the dry season. Of course it also arrives during the wet sea-

*Allis-Chalmers Co., Santiago, Chile.

son, but as lumps of stone. Even the bags are useless. Llallagua has lately completed an ideal little hydro-electric power plant under the technical direction of Oscar von Chrismer. The site is about as far from civilization, measured by difficulties, as it could be. The dam site is ideal, and a minimum supply of 300 kw. is assured the year round, though the rainfall is very irregular. The power plant is German, the equipment is all that could be desired.

Before this plant was built, power was supplied by producer-gas engines with anthracite at a fabulous number of pounds sterling per ton. As anthracite must be transported on the llama, it is necessary to provide stock for several months, so that no advantage can be taken of a shortage to raise the freight rate. There is no interstate commerce commission in Bolivia. The hydro-plant supplies the same 50-cycle three-phase current, so that the gas-engine plant can now be held as a stand-by unit.

The superintendent at the mine is Sr. E. Diaz, a Chilean with home and foreign experience, including a long period in the States, and he has been wisely permitted by his management to surround himself with a corps of assistants of his own choosing.

The mine is several kilometers from the mill. Ore is brought down by an aërial tramway, the drop from the mine to the mill being sufficient for its operation. The buckets are small and the rope is light, but the combination serves admirably. Bolivia is marked up with these single-line tramways, and one is easily converted to their use. They give little trouble, and this trouble is easily remedied. The buckets are simply hung on the line, not gripping it in any way, friction alone keeping them in place. Where the line is steep, this friction sometimes becomes a minus quantity. The buckets that then accumulate at the foot of the towers remind one of the impression which the English cabled news gives of the poor German artillerymen, the only difference being that the buckets are soon again in working order.

Native Labor Improvident

The miners in Bolivia are Bolivians. In the States the miners are of all nationalities, but no one can replace the Bolivian, as no one else can work at that altitude. The miner uses an 8-lb. single-jack in drilling, holding the handle close to the hammer-head and striking a very short shoulder-and-body blow. They seem to strike hard and to get results. I have tried the hammer. After a very few blows, it was necessary to stop and rest. With only 8 lb. atmospheric back pressure for the lungs, it is absolutely impossible for anyone not accustomed for years to the altitude to do hard labor. At one mine we rode up the hill on mules and walked down the trail upon returning, and though the walk was scarcely a mile, I was entirely done for. Then to think of anyone not Bolivian born really attempting to work at that altitude seems nothing short of foolhardiness. All the foregoing leads to the fact that the Bolivian Indian is the only possible laborer and that consequently he should be conserved carefully. Instead of that, he is encouraged in the use of pure alcohol, and no effort is made to protect him and his family in winter. Snow and ice are colder in Bolivia than elsewhere, and as the laborer is not of a saving disposition, he usually becomes resigned to going through the winter with his summer clothes. Far from having any savings, he is usually indebted to his employer well in advance of what he has earned. Some plant managers are so anxious to hold men and keep them in good humor that very liberal advances are countenanced, though this frequently results in the laborer going elsewhere rather than work out his debt. With all their lack of foresight, they are very independent, as the demand for labor is in excess of the supply. Holidays are as frequent as in the States, and 200 working days is the usual year's run. The companies include in their reports the explanation of time lost for feast days, with the names of the saints which are the cause.

The little children are neglected absolutely, from the American point of view, and one need not go far in Bolivia to find conditions that seem susceptible to improvement. If I were a mine owner in Bolivia, I think I should gather up the older children and take care of them, in the hope that my job would last long enough to make it worth while. Not much would have to be done to help them considerably. For example, I was caught in a snowstorm between Antequera and Totoral one day in June. Walking ahead of my horse was a band of Indians with packs and children. The snow was heavy and froze on my overcoat and overshoes as it struck. The wind was dead ahead, and my horse declined several times to face it. Some of the adults were fairly well protected so far as their bodies were concerned, but what annoyed me was the bare feet of the little fellows. The snowstorm did not last long—but I will see those little toeprints wherever there is cold, glistening snow.

Children, and especially girls, who are constantly exposed that way cannot grow up to be good laborers. To be sure, if they are not strong, they are still useful for hand breaking and sorting of ore, but what is most required is strong men and women that can do heavy work and carry heavy loads. It would not be very expensive to feed the children and keep them warm in winter, and doesn't it seem possible that they would be appreciative enough so that a worth-while percentage would stay right along? I have no doubt all this sounds Utopian to a real mine manager in Bolivia, but it would be fun to try it.

On a street car in La Paz, a lady of the upper class met a friend; she had a little Indian boy with her, dressed nicely and looking happy. The lady explained that his Spanish was not good yet, as she had bought him only a short time before. The sale is of course not legal, but the scheme is to get the parents to swear that the child is not theirs. Then the parents cannot make trouble. It is merely another method of adoption, as of course the child can leave whenever he decides to do it. Another instance of this occurred when a Spanish opera singer and his wife bought a little 9-year-old Indian girl while on a trip through Oruro. I met them on the steamer en route to Spain. The contrast between the fair Spaniards and the dark red girl was striking and caused much comment. I wonder what the outcome of that experiment will be.

Hand Labor Is Not Much Used in the Big Mines

The big mines like Llallagua, Oruro, Oploca and Sr. Patiño's are gradually doing away with much of the requirement for hand labor by the introduction of modern machinery. Hand crushing is nearly gone. Hand sorting is gradually disappearing before the modern mill that can make a profit on very low-grade ores, though sorting is still worth while where it is possible to make a shipping grade, without further handling.

The old hand-rabbled furnaces are being replaced by McDougal or other similar mechanical roasters, even where silver is present and chloridizing roasting must be done. The hordes of contractors that formerly worked over the tailings, selling their product back to the companies, are slowly being driven to doing useful work, while what they formerly did is being done within the mills by tables, vanners and other similar and more or less successful substitutes for human effort. It is necessary to say "more or less successful" because, after seeing these people washing ore about 50 times by hand in order to raise the grade of the concentrates a few points, it seems impossible that a machine could be made that could take their place. At one mill (which I am afraid to name until the order is placed) I have actually seen, and you may now see, a woman feeding each table by hand from a little pile of sand, with another sitting at the foot of the table who from time to time shifts a little tin divider which separates concentrates from middling. This is not a temporary expedient, because both women have rigged up very comfortable chairs or thrones of candle boxes and ore bags.

TYPE OF TOWN AND PEOPLE OF THE BOLIVIAN MOUNTAIN COUNTRY

The hand-roaster men work 24-hr. shifts. They like it better, and apparently there is no reason for changing the system. The roasted ore, where no silver is treated, is concentrated on jigs, tables and vanners and then on canvas plants or automatic wooden slime tables. These latter raise the grade of the tailings from 1 or 2% to 6 or 8%, and the concentrate is either worked over in a confusing multitude of round buddles or on vanners. Sometimes the sand is returned to the mill for regrinding, the women packers being able to carry about 50 lb. up the sidehill and the ladders to the Huntington and Chilean mills. Only in the larger and more progressive mills has the grade of the mill tailings been reduced so low that there are no contractors working them over. Speaking of tables, vanners and machinery generally, let me give my competitors a hint. There is nothing that so successfully convinces your customer that you know how to supply his needs as the inclusion of a large list of spare parts with every machine sold. Some manufacturers go so far as to regularly quote a price that includes a liberal supply of spares—and it is a good practice for South America. Remember that though you ship from your factory today, the merchandise does not leave New York for two weeks, and if the customer is in Bolivia, the time required for the shipment to reach Mollendo, Arica or Antofagasta, be transported on the railway and finally reach the mine via llamas, has totalled around three months. Then perhaps some case or part will have been left at the wrong port or broken, and he will have to cable for a duplicate, which will be another three months on the way.

Many of the Bolivian mines have producer-gas engine plants, some using anthracite and others charcoal. The Diesel is now coming into its own, since it is possible at present to buy Peruvian crude oil in the mining region. The altitude decreases the rating of the engines at an alarming rate, but once having admitted that gas and oil engines lose half their capacity at 12,000 ft., the point is not discussed.

The Oruro company has been very successful, treating different grades and kinds of ore. Part of the ore can be concentrated directly, while some of it requires roasting and silver leaching with hypo previous to concentration for tin. Not long ago this company erected a complete modern tailings plant, which includes classifiers, thick-

eners, grinding pans, Richards-Janney classifiers, tables and vanners. The report for the six months makes such a good showing that modesty alone prevents my quoting it in full. There are large deposits of tailings of bygone years, and the regrinding and reconcentration of these is proposed, using tube mills.

Until lately and for several years, tin has been at a very good price. The war has put an end to that, and the lack of interest on the part of the American consumer of tin is resulting in the storing of a large amount of Bolivian tin until such a time as it can again be shipped to England, smelted there and sold to the States.

The Oruro has a special McDougal equipment which has reached a capacity close to 45 tons of 20-mesh pyrite per 24 hr. Considering the altitude and the fact that chloridizing roasting is done after the product leaves the McDougal, this is a high capacity. When everything is going properly, it will be possible to dispense with the hand roasting furnaces and thus free a lot of men who are needed for other work.

One of the most successful of the tin-mining companies is the Oploca. This is one of the few that has had the courage to continue shipping tin concentrates to England in spite of not having a cabled market price to figure on. The tin is simply shipped to England and when it arrives, it is sold. It sounds simple, but heretofore the tin could be sold before it arrived and the shipper knew where he stood at all times. It really takes courage to continue shipping, but the results so far have proved that Oploca has done well. While the prices secured have not been as high as it would have been willing to accept, it has been able to go on working, and it could not have done this had it continued to store its tin. It is remodeling the plant and has reached a higher efficiency than ever before.

In nearly every tin mine, classification and ultimate fine-grinding is the pair of vital and all-important items. At times it is necessary to roast the first concentrates in order to eliminate sulphides of iron and other metals, followed by a second concentration. Near Potosí there is the further complication of much iron in the ore, part of which can be removed by magnetic separation, and I believe that if an additional 5% of waste material could be removed from the tin concentrates, it would be easy to sell a machine worth £1,000 to handle 20 tons daily. Each per cent. of waste in the concentrates increases the charges against the shipment to such an extent that the cost of removing is sure to be less than the amount saved.

The gentle reader will remember from his geography lessons that Potosí is the place where the silver came from. At present, however, very little silver is shipped from there, the mines now producing mainly tin. It is a fine camp for some enterprising Englishman or Frenchman to combine under one ownership and work properly and economically. There are many curious and confusing mining regulations which make such a project next to impossible, but it is a pleasant thing to contemplate.

These notes should have been written months ago—before the bad feeling broke out abroad—because what were interesting and active mines before are mere liabilities now. None of the mines are working with full forces, and all but a few are closed down. None is really large, it is true, a production of 100 tons per day being enough to place a mine in first rank, but all were making money and buying machinery. To mention buying now would be to invite disaster.

Production of Explosives in 1915

The production of explosives in the United States, excluding exports, during the calendar year 1915, according to figures that the Bureau of Mines[1] has received from manufacturers, was 460,900,796 lb. (230,450 short tons), as compared with 450,251,489 lb. (225,126 short tons) in 1914. The report covers only the explosives used in coal and metal mining, railroad construction and other industrial enterprises.

The production for 1915 is segregated as follows: Black powder, 197,722,300 lb.; high explosives, other than permissible explosives, 235,828,587 lb.; and permissible explosives, 27,349,909 lb. These figures represent a decrease of 8,377,400 lb. of black powder, and increases of 17,374,616 lb. of high explosives and 1,652,091 lb. of permissible explosives as compared with figures for 1914.

The returns received by the bureau show an increase in the production and sale of permissible explosives for use in coal mines. In 1902 only 11,300 lb. of permissible explosives were used in coal mining, whereas in 1915 the quantity so used was 21,841,659 lb. The quantity of permissible explosives used in the United States in 1912 represented about 5% of the total quantity of explosives produced and 5.9% in 1915. The total amount of explosives used for the production of coal in 1915 was 196,739,634 lb.

Negligent Hoisting of Employee

By A. L. H. Street*

In an action against a mining company for injury to an employee while being hoisted up an inclined shaft, due to the ore bucket in which he was riding leaving the skids upon which it ran, it is held that the evidence warranted findings that the accident was caused by negligence of the hoisting engineer in hoisting the bucket at full speed, and not through a tamping stick carried by plaintiff; and that, through previous practice at the mine, signals given the engineer sufficiently indicated that a man was to be hoisted.

Negligence of the engineer in this respect cannot be excused on the ground that the hoisting signals given him did not conform to those prescribed by statute, it being sufficient that he should have understood from established custom in the mine that a man was to be hoisted. (California Supreme Court, Gibson vs. Kennedy Extension Gold Mining Co., 156 Pacific Reporter, 56.)

The Trethewey Silver-Cobalt Mine, Ltd., Cobalt, Ont., reports for the year ended Dec. 31, 1915, that operations were suspended on Feb. 28, because of shortage of power, and that the mine then remained closed because of the low price of silver. At the end of the year ore reserves were estimated at 26,774 tons containing 507,339 oz. of silver. A total of 6,113 tons of ore were milled at a cost of $1.18 per ton, producing 76 tons of concentrates containing 85,004 oz. silver, the average recovery being 80%. In addition 40 tons of ore from 1914 containing 41,486 oz. was shipped. Of these shipments, 74,635 oz. of silver remained unsold in London on Dec. 31. Total expenditure amounted to $37,762 and total receipts to $44,214, leaving profits of $6,452. The work of pumping out the old Rochester mine at Cobalt was started July 26, 1915, and 352 ft. of exploratory work was done.

[1]Technical Paper 159. "Production of Explosives in the United States During the Calendar Year 1915," by A. H. Fay. 1916.

*Attorney at law, 829 Security Building, Minneapolis, Minn.

The Labor Situation

High wages caused by a shortage of labor, making it impossible to get enough men for three 8-hr. shifts, are held responsible by the heads of more than a hundred manufacturing concerns in Pennsylvania and New Jersey for a condition of decreased production which has become so serious that it threatens to cause the closing of several plants. The opinions were expressed in response to letters of inquiry sent out by Federal Reserve Agent Richard L. Austin of the Philadelphia district.

Manufacturers unite in the assertion that increased wages have been directly responsible for lessened efficiency of labor. They have had trouble keeping men at work. One manufacturer wrote that the motion-picture houses are filled with workingmen every day in the towns near large factories and that there is plenty of evidence elsewhere that labor is not taking advantage of the present situation to benefit itself.

With wages at high figures the manufacturers say labor has become inefficient. Instead of taking advantage of the rates to save money or better their condition, a large proportion of the workingmen take holidays after they have earned a sum equal to their usual weekly wage. And even while at work, according to the employers, they are becoming lazy and independent.

This complaint of lack of discipline runs through nearly every letter received. The employers assert that all classes of workmen are seeking more money, despite increases of from 10 to 40% since the war started, and that they take the first excuse to walk out or strike. One manufacturer wrote that his men "simply disappear" without a word as to the cause of their dissatisfaction.

The Propensities of Labor

One manufactur wrote: "Labor as a whole, certainly east of the Mississippi and north of the Mason and Dixon line, is suffering from a species of insanity. It does not know what it wants, but it wants more. However, one cannot help, in studying cause and effect, realizing that this is effect. The cause does not lie altogether with labor. It lies with another element in our American life which is also suffering from a species of insanity. What would you think of a statement of a president of a very well-known concern, to the effect that ordinarily they would be satisfied with a $2,000,000 net profit annually, but which this year expects to make $25,000,000?—enough money in one year to shut its plant down and have sufficient profits to last eleven or twelve years and do nothing. Who could blame the employees of such a concern for demanding more? It is undoubtedly our judgment that a continuation for any considerable time of the present-day conditions will put a quietus on general business."

One manufacturer of metal products suggested that "a great deal could be accomplished in minimizing labor troubles if the local newspapers would agree not to publish so many news items on labor conditions, or instead, simply make small reference rather than devote columns to the subject, as they have been doing of late."

Another in the same line said: "The most serious difficulty with them (workmen) is that the more money they get the less work they do. They have become so independent that it is very difficult to keep discipline, and instead of attempting to earn more money at the high rates, they simply reduce the amount of work they turn out or else take time off when they have earned the weekly wage to which they are accustomed."

An iron and steel firm wrote that its increased labor cost is 37%; adding that "every increase in wages granted has been followed by a decrease in efficiency on the part of our employees, so that the actual increase in labor cost to us is much greater than stated. The matter is so serious that there is but one thing to do, and that is to close the plants until such time as labor conditions are more settled and we have a fair assurance that rates of wages will remain constant a few weeks."

Another steel company suggested that "instead of realizing that the present harvest is likely to be short and working steadily and saving money," the workmen "are inclined to be extravagant and wasteful of times." The same firm said that workmen are not willing to give a reasonable return for the present high wages, their production being far below what it was at the old and lower rates.

"It is evident from these letters," said Arthur E. Post, assistant agent of the Federal Reserve here, "that labor has failed to recognize the crisis which is confronting it. Labor has cut off its nose to spite its face. The result will be a deep reorganization of industry and a fundamental change in the relations between capital and labor at the close of the war."

Mining in Australia

Sydney Correspondence

A peculiar state of affairs affecting mining in Australia has been brought about by the European War and other causes, which bids fair to create disaster to the mining industry of the commonwealth. That it has not created more comment is due largely to its being misunderstood or unknown to one faction, the operatives, and so eminently satisfactory under the present condition to the other, the operators.

At the time when electrolytic copper was selling at about £100 per ton and had apparently reached its highest point, several of the largest producers, among which were the Walaroo & Moonta, the Sulphide Corporation and the Mount Morgan company for themselves and for their (Port Kembla) refinery, entered into a contract to deliver to the Allies a tonnage equal to a year's product or more, at £100, the total so contracted amounting to 15,000 to 18,000 tons.

As the price of copper rose above £100 there was great danger of a "pinch," when, by order of the Attorney General, a Metals Exchange was formed. This exchange, to be composed entirely of British subjects, is to handle all metals produced in the commonwealth with the exception of gold, and only electrolytic copper or copper bars too low in gold and silver to warrant refining were to be exported even by members of the exchange. Members were to be responsible to the government for the delivery of the copper to the Allies only, and a nominal commission was to be charged for the handling of all metals to be exported. Each consignment of copper was to be shipped only on special permission granted by the Attorney General through the secretary of the exchange, the latter having no knowledge of the metals-selling business, but holding his position by virtue of the Attorney General and acting for him.

As the price of copper continued to rise, a maximum price of £100 was fixed by the Attorney General. The president of the Sydney Chamber of Commerce (Mr. Beale) states that this price was fixed by "patriotism," but as it was not made voluntarily by producers not in on the £100 contracts, nor has this "patriotism" extended to efficiency or contentment on the part of the operatives who still continue to strike for shorter hours and more pay with no possible thought of "speeding up" to help out the home government, it looks more like government aid to help out the "shorts." Inasmuch as it is known that the Port Kembla company offered 500 tons of copper produced from custom ores at market, then around £135 per ton, and through some blunder on the part of the sales agent offered it to the government in place of an outside consumer, the patriotic theory does not look right. At any rate the government demanded the consignment as a part of the contract, and got it.

Customs smelters are refusing to buy ores or else charging an exorbitant rate for treatment. Quotations on ores containing 30% Fe and 30% S were as follows: 18% Cu, $14.10; 20% Cu, $14.70; 25% Cu, $16.20; an increase of 30c. per unit of content. This rate was quoted by the English & Australian Smelting Co., which makes copper bars only and pays for no gold or silver content in the ore.

The steady increase in wages allowed by the court, the slacking-off process followed by the miners and the present fixing of prices by the government so as to protect the large operators who sold short bids fair to retard prospecting, close the few workable mines outside the "ring" and create the suspicion that there is "a nigger in the woodpile."

Meanwhile strikes are of daily occurrence. A 44-hr. week granted to the Broken Hill miners is the forerunner of a general 44-hr. week, and a good start toward a five-day week.

Poor Condition of Industry

There is some talk of government ownership of smelteries and refineries. This, while allowing the present owners to get out of a hole, will not help the industry unless there is a decided improvement in methods over those employed in the telephone service and the state-owned fisheries, brick works, railways, etc., all of which are run at a substantial loss. New South Wales, run on 75% borrowed money, has not curtailed expenses, and under the mask of "aiding" the idle, who might well be employed in remunerative work, is spending millions in Sydney. Wheat commandeered by the government has not been paid for and it is reported that the banks, which advanced the money for the primary payment to producers, have refused to make further advances. Thousands of bags of wheat lie along the railways, much of which has been ruined by the rain. It's nice to divide up some other fellow's property.

We have just been having an "investigation" on an "oil monopoly" whereby a member of the State Cabinet has been tried for conspiracy. Most of the responsible business men say "whitewash." Copper would stand an investigation, to say nothing of Dalghety's monopoly on tungsten and molybdenite (this last for the benefit of Australian metal buyers).

Were it not so realistic to some of us, the whole government might be considered as a huge joke. The Labor party has dug a hole which it has left for the Liberals when it loses power, and with a national debt greater than that of the United States, without taking into consideration the increase caused directly by the war, even with the enormous resources of the country the outlook is not promising.

Commodity prices have all been fixed by proclamation, wages temporarily fixed with every prospect for a generally shorter week at an increased wage, and the candle now burning at both ends must soon "do su'th'n."

Impurities in Sulphuric Acid from Blende Roasting

A. Hoffmann, in *Metall u. Erz,* XII, 290, 310 (through *Journ. Soc. Chem. Ind.,* Mar. 31, 1916), states that the gases from blende-roasting furnaces contain suspended dust and this forms the chief source of the impurities in the chamber acid. The incrustations which form in the chambers, etc., are as hard as stone and cannot be removed by washing with water. They are probably composed of acid ferric sulphates. A microcrystalline, grayish-white, very hygroscopic sludge from a settling tank for the 60° B. (sp.gr. 1.71) acid had the composition, $Fe_2(SO_4)_3,3H_2SO_4,8H_2O$; on exposure to air it absorbed moisture and yielded sulphuric acid and $Fe_2(SO_4)_3,H_2SO_4$. The incrustations contain a crystalline sulphate of the composition, $Fe_2(SO_4)_3,H_2SO_4,7H_2O$, and sometimes, when they are of a greenish-yellow color, $Fe_2(SO_4)_3,H_2SO_4,11H_2O$ or $8H_2O$.

The lead sulphate present in the chamber sludge is the normal sulphate. When aluminum sulphate is found in large quantities, it is present as acid sulphate, which can be obtained in the form of snow-white glistening leaflets, $Al_2(SO_4)_3,H_2SO_4,14H_2O$, easily soluble in water. Zinc sulphate mostly remains in solution in the Glover tower acid, but is present in the incrustation formed in the Gay-Lussac towers, which contains 63.7% $ZnSO_4,H_2O$, 9.7% $PbSO_4$, and 21.1% $Fe_2(SO_4)_3,H_2SO_4,8H_2O$. In the concentration of the acid porous yellowish-white amorphous crusts of $Fe_2(SO_4)_3,H_2SO_4$, and hard white crusts are formed; the latter probably consist of a pyrosulphate, $Fe_2(SO_4)_2(S_2O_7)$. A very hygroscopic acid zinc sulphate, $ZnSO_4,3H_2SO_4$, may also separate during concentration.

Mining in Alaska

The Alaska mining industry will have a very prosperous year in 1916, according to a statement by Alfred H. Brooks, of the United States Geological Survey, covering the operations during the first six months of the year.

Copper mining will probably show the greatest advances. About 15 copper mines are now shipping ore, and developments are being pushed on others, indicating that they may become producers before the end of the year. There is every reason to believe, therefore, that the Alaska copper output for 1916 will be greater than that for any previous year. The gold lode mines of Alaska will also make a larger production this year than last, but it is not now expected that the placer-mining industry will show any marked increase. The shipment of antimony is continuing, and some tungsten ores have already been shipped from the Fairbanks district.

Drilling and Analysis of Copper Ores

By A. J. Sale*

SYNOPSIS—Discussion of the errors that may occur from the usual methods of figuring averages from churn-drill hole samples and the application of the law of compensating errors. Comments on assaying of churn-drill samples and a plea for wider use of the sulpho-cyanide method for copper assay. Examination of effect of mineralogical analysis of ores on determination of mining and milling practice, with concrete example.

Within the past few years a new term has crept into mining phraseology, usually expressed as "ore blocked out by churn drills." While this expression is freely used, particularly with respect to copper mines, it is safe to say that a great many investors, together with a few engineers, do not really understand what it is intended to cover. Of course all mining men know what a churn drill is and know that the pulp from the holes discovers the ore and that the ore so discovered is estimated from the samples taken. Only a few, however, have stopped to consider what is assumed in these calculations.

Some companies—probably most companies in local zones—have used holes placed at random over a given territory. Such samples will give fairly accurate but more complicated figures than the so-called "systematic blocks" to which I will confine this discussion. These blocks are surveyed squares, usually either 100 or 200 ft. on a side, covering the orebody. The holes are drilled at the corners of the blocks and samples taken of every 5 ft. of drilling. Leaving the sampling for future discussion, I will attempt to show what fundamental principles are involved in making the calculations for tonnage and grade of ore.

Different Methods of Combining Samples

Different engineers have different ideas concerning the method of combining the holes in the calculations. Most of them take four holes as the corners of a block and assume imaginary lines connecting the top of ore in one hole with the top of ore in the adjacent hole, and so on for each of the four sides. The bottom of the ore is outlined in a similar fashion. Corresponding pairs of lines and the drill holes themselves form planes that make the bounding sides of a solid theoretically containing all the ore in the block. The assay value of each hole is assumed to continue halfway to the next boring. This introduces another set of imaginary vertical lines midway between each pair of holes. If a plane is assumed between each opposite pair of these lines, we shall have two new planes which cut the original block into four sub-blocks, the volume (tonnage) of each of which is calculated while the grade is taken as identical with that of the drill hole at its corner. The tonnage and grade of a main block is the composite of its four sub-blocks, and a composite of all of the main blocks gives the tonnage and grade of the orebody.

*Battle Mountain, Nev.

In this method of estimation each interior drill hole is used for its four contiguous sub-blocks, thereby entering four times into the general calculations. From a practical standpoint, where large areas are involved, this is equivalent to assuming the vertical planes so shifted that each drill hole lies in the center of a block the volume of which is equal to the thickness of ore times the horizontal area of the block and the grade the same as that of the drill hole. Where active work is progressing some engineers use this direct and simple method of calculating at the start. In any case, neglecting minute variations by the first method, each 5-ft. sample represents a volume five times the horizontal area of a block. If 200-ft. blocks are used, each sample represents 200,000 cu.ft., or 16,000 tons of ore, assuming 12½ cu.ft. per ton. If 100-ft. blocks are used, each sample represents 50,000 cu.ft., or 4,000 tons of ore.

In a vague way a few skeptics appreciate these figures and condemn any method of blocking out by churn drills, as they claim that for one sample to represent from 4,000 to 16,000 tons of ore in an area of from 10,000 to 40,000 sq.ft., is an assumption that is too far-fetched to be practical. But if these men will investigate the law of compensating errors, they may take a broader view of the subject.

The sampling of the pulp from churn-drill holes is a field open to improvement. The mechanical features may be worked to perfection, but the human element yet remains. If an investigator will take the trouble to put on a pair of overalls and make friends of some of the men who are doing the actual work, he may discover some serious flaws in sampling that is supposed to be perfect. I know that some engineers will affirm that with automatic samplers they have obtained from drill holes assays which checked to perfection with those from a raise put up alongside of the hole from the mine level below. But this close checking is due more to the uniformity of the ore than to the method of sampling. I have seen the same check obtained from grab sampling.

Grab Sampling Gives Better Results Than Generally Supposed

Where grab sampling is followed, the pulp is thoroughly mixed by churning with the bailer, and one bailerful of pulp is taken out and kept as representative of the whole. While I do not recommend this system I am convinced that, where applied honestly, it will give good results. Its underground equivalent consists in taking samples in a crosscut at spacings of every 5 ft. instead of taking a sample over the entire 5 ft. Any engineer who has sampled large bodies of fairly uniform ore knows that these results will check closely. Certain engineers make a practice of condemning other people's churn-drill samples, just as they condemn any other work which they do not receive a high salary to supervise. Sometimes it so happens that these same engineers supervise drilling in the neighborhood of holes that they have condemned, with the result that their work is more open to criticism than that which they refused to accept. While

I repeat that I do not recommend this system, I have seen it check up with the result obtained from underground sampling in a given block of ground, within 0.2% copper.

The theory of automatic sampling is perfect; its practice needs much watching. The automatic sampler usually consists of a wooden box in which are placed riffles similar to those used in the assay office. These riffles are set at an angle of about 45° to allow the pulp to flow freely through the troughs. The spaces between the troughs are equal to the width of a trough, so that when the pulp strikes it will be equally divided. Underneath the set of riffles is placed a similar set to divide again the pulp that comes through. If sufficient vertical height is available, a third set is used, which will take out one-eighth of the original pulp. If the amount of original pulp is not so large that the sample obtained requires further subdivision, the action of this sampler is practically perfect. But it usually happens that the sample as taken is too large to dry, and here is where the human element comes in. If the laborers can be depended upon to pick up the sample tubs and empty them back through the sampler the resultant sample will still have its original accuracy. But the only way to insure that this is properly done is to seal all possible exits for pulp except through the riffles and "fire" any drilling crew which has any misplaced pulp. I know of one company that drilled two large bodies of ore and sampled with an automatic sampler. During this drilling it was a prevalent custom, especially on night shift, for the laborer employed to "slop-out" any excess samples from the tubs, instead of pouring them back through the sampler. It so happened that one of these orebodies was characterized by chalcocite, while the other was chalcopyrite accompanied by nearly barren pyrite. In this "slopping-out" process it is probable that the chalcocite would concentrate and give assays too high while the pyrite would crowd out the chalcopyrite and give assays too low. It is safe to say that this company could have obtained better information if they had trusted to systematic and careful grab sampling.

It is not out of the realm of extreme possibility to put down a hundred drill holes and have each one of them strike a chimney of waste or ore, as the case may be. But it is very much within the laws of probability that one hundred drill holes will represent a fair average of the territory covered by them. Modern mining does not pay much attention to freak possibilities; it is governed by the laws of probabilities.

Application of Law of Compensating Errors

One of the branches of probabilities is the law of compensating errors, which, practically stated, is "that in a series of determinations whose errors are compensating, the probable mean error will be the probable error of any one determination divided by the square root of the number of determinations." To apply this law to churn-drill sampling we will assume an orebody containing 10,000,000 tons of ore which was blocked out by churn-drill holes of 100-ft. spacing. As previously explained, for practical considerations each 5-ft. sample will represent 4,000 tons of ore. Therefore this orebody is determined by 2,500 samples. Assume that these samples have been crude yet perfectly compensating "grabs," and to be on the safe side we will assume that all of these samples are in error by an amount of 1% copper. We now enter our "law of compensating errors" with 2,500 determinations, the probable error of any one of which is 1% copper. The square root of 2,500 is 50, therefore the probable error of the orebody average will be $^1/_{50}$ of 1%, or 0.02% copper. It is almost a certainty that if this orebody is worked out, it will produce ore that will not vary by more than 0.02% copper from that predicted by the churn drills, although any individual sample was in error. Of course, in these calculations, it is assumed that perfect compensation has taken place, that any one sample was just as liable to be 1% too high as 1% too low, or vice versa. On the other hand, if more accurate sampling was used, so that the probable error of any one sample was reduced to 0.1% copper, the final error of the orebody average would be reduced to 0.002% copper.

It is evident that the more nearly a condition of perfect compensation of errors is introduced, the better will be the results, therefore it is probable that better results will be obtained by using a systematic block system than by random drilling.

Any manager who trusts his copper assaying to any one man, without any kind of a check, is courting commercial suicide. In clean chalcocite ores any assayer with a reasonable amount of experience can obtain fairly accurate returns, but in refractory ores containing chalcopyrite and other complex sulphides it requires extreme care to dissolve all of the copper. If the ore is very refractory and the assay carelessly manipulated, with insufficient acids, it is probable that a large amount, sometimes nearly all, of the copper may remain undissolved. The most serious errors that I have seen in this connection were in one drill hole where over a hundred feet of nearly 2% ore was reported as 0.5%, and in another hole where the same grade of material was reported as 0.1%. As it happened that these holes were in important positions, these results were a serious misfortune to the company that drilled them.

Inaccurate Assaying Responsible for Poor Results

A large amount of error that is charged to poor sampling is really due to inaccurate assaying. If every copper company would preserve a sample from all its drill holes, no matter how crude the sampling methods, it is safe to say that they would profit by it. Such samples are valuable from a geological standpoint, even if they do not contain a trace of copper. A company may drill a thousand feet through leached formation before reaching sulphides; if the only records kept were the assays, it would be impossible to tell, in a later study, whether to deepen the hole or not. I know of one case where a company, taking over a new property, destroyed the records of a vast amount of drill pulps, representing a cost of several hundred thousand dollars, as they asserted that their manager had a "nose for ore," which would lead him into "values" undreamed of. It unfortunately happened later that this manager inaugurated his drilling campaign during an epidemic of hay fever, and his innovation of olfactory prospecting led him into serious disaster.

For control work and composites, where high accuracy is required, I consider that by far the most satisfactory method of assay is the sulpho-cyanide. Strange to say, little mention is made of this method in books on as-

saying and in general technical literature. I first heard of it from Mr. Nielson, chief chemist of the Nevada Consolidated and was given the essential details of its manipulation by Mr. Morgan, assayer for the Veteran mine at Kimberley, Nev. Both of these men made statements in regard to the accuracy of this process that I could not comprehend until I had tried it. After a week of careful work any assayer can easily master this process so that duplicate assays on low-grade ores will check by an amount not greater than 0.005% copper.

For ordinary drill samples the cyanide assay will give practically perfect results if the pulp that is being assayed is used to standardize the cyanide solution. The sulpho-cyanide assay, being both rapid and efficient, is very handy for this purpose. The assayer makes a composite of his day's work and runs a sulpho-cyanide assay on this composite, after which he uses it as a standard for his day's work. As a final check, the average of the assays for the day should be within a very few hundredths of 1% of the direct composite assay. This gives an idea of the value of the method for the usual estimating work.

Mineralogical Analysis Important to Large and Small Operator Alike

With large companies owning their own smelteries, mineralogical analysis of their ores is a matter of considerable assistance; with smaller ones, which have to ship their concentrates to a foreign smeltery, it is a matter of vital importance—almost as important as the copper assays themselves. By mineralogical analysis I mean the determining of the actual minerals in the ore by chemical analysis and calculation. The amounts of heavy minerals are of especial importance, as they determine the concentrating ratio, which means the direct index of the smelting cost. Even large companies can profit by this information, for if their smelting capacity should become crowded, it would be of great advantage for them to direct their mining to ores with high concentrating ratios.

The determination of the separate silicates in the insoluble is important to companies owning their own smelting plants, as certain feldspars are more liable to go into the concentrate than quartz. But for smaller companies the ordinary insoluble determination will probably be sufficient unless the rock contains silicate of copper. Clay, when properly treated, can be dissolved in hydrochloric acid and should be determined separately. This analysis should be made on both oxidized and sulphide ores. The most valuable way to composite drill pulp for this type of work is to predict the method of mining and composite along these lines. If the steam shovel is to be used, make the composites conform to the shovel benches; if underground mining is contemplated, make them conform to the stopes.

I will not attempt to enter into the details of the analyses, but will show a few characteristic types:

OXIDIZED ORE

Ore	Copper, as native	Trace	
	Copper, as sulphate	0.20%	
	Copper, as oxides	0.79%	
	Copper, as carbonates	1.65%	
		2.64%	total Cu
Acid consumers	Limestone	4.50%	
	Clay	5.50%	
	Ferric oxide	6.30%	
Neutral	Magnetite	1.20%	
	Insoluble	69.20%	
	Gypsum	2.20%	

The acid consumers are important where leaching is contemplated.

PORPHYRY ORE

Heavy minerals	Ore: Chalcocite	2.50%	Gold, 0.015 oz.	
	Ore: Chalcopyrite	0.85%	Silver, 0.03 oz.	
			Copper, 2.29%	
	Magnetite	1.20%		
	Pyrite	4.50%		
		9.05%		
Fairly heavy minerals	Ferric oxide (Garnet)	0.45%		
Light minerals	Insoluble	81.20%		
	Clay	4.40%		
	Limestone	1.10%		
	Gypsum	0.50%		

Assuming that the small amount of ferric oxide will go into the gangue, we have 9.05% of this rock as heavy minerals, which will go into the concentrate under ideal concentration. Therefore, theoretically the ore will concentrate 11 : 1 and the concentrates would carry: Copper, 25.19%; gold, 0.165 oz.; silver, 0.33 oz.

SILICIFIED LIME ORE

Heavy minerals	Ore: Chalcocite	0.48%	Gold, 0.02 oz.	
	Ore: Chalcopyrite	3.67%	Silver, 0.05 oz.	
			Copper, 1.65%	
	Magnetite	2.10%		
	Pyrite	6.25%		
		12.50%		
Fairly heavy minerals	Ferric oxide (Garnet)	0.35%		
Light minerals	Insoluble	68.00%		
	Clay	5.50%		
	Limestone	6.30%		
	Gypsum	2.80%		

As 12.50% of this rock is heavy mineral, a theoretical concentrating ratio of 8:1 is indicated, which would produce concentrates carrying: Copper, 13.20%; gold, 0.16 oz.; silver, 0.40 oz. The garnet, being usually a small factor hard to determine, can probably be neglected, allowing that which is magnetic to go with the magnetite. The determination of clay and limestone will prove valuable information in connection with the milling, especially where oil flotation is used. But by far the most important features are the heavy minerals.

For example, let us assume that a company is operating its own mine and mill, but is forced to have its concentrates smelted by another company at a charge of $7.50 per ton, a recovery at the smeltery of 95% and a charge of 1¼c. per lb. for bullion freight and refining. Also let us assume that the company's local costs are: Mining, 40c. per ton; transportation, 15c. per ton; milling, 50c. per ton; and that the company saves 70% of its copper and 20c. per ton in precious metals. Also, if the mill saves 70% of the heavy minerals in a concentrate which carries 30% insoluble, let x pounds represent the amount of heavy minerals in a ton of original ore. Then there will be 70% of x pounds of heavy minerals produced in a concentrate which is 70% heavy

Conditions:	Ore A	Ore B
Analysis	2% Cu	1% Cu
Heavy minerals	33%	5%
Concentration ratio	3 : 1	20 : 1
Copper content	40 lb.	20 lb.
Mill saving (Cu)	28 lb.	14 lb.
Smelter recovery	26.6 lb.	13.3 lb.
Costs of Production:		
Mining	$0.40	$0.40
Transportation	.15	.15
Milling	.50	.50
Smelting ½ ton @ $7.50	2.50	.....
Smelting ⅜ ton @ $7.50	....	.375
Refining 26.6 lb. @ 1.25c.	.332	....
Refining 13.3 lb. @ 1.25c.	....	.166
Total production cost per ton	$3.882	$1.591
Value of Product:		
Copper 26.6 lb. @ 14c.	$3.724	
Copper 13.3 lb. @ 14c.	....	$1.862
Precious metals (95% of 20c.)	.19	.19
Total value recovered	$3.914	$2.052
	$0.032	$0.461

minerals (30% insoluble, the rest heavy). Therefore the actual weight of the concentrate produced will be $0.7x$ divided by 0.7, or x pounds, from which it is seen that in this case the actual concentrating ratio will be identical with the theoretical. We will now compare the profits from two ores, one having double the copper content of the other.

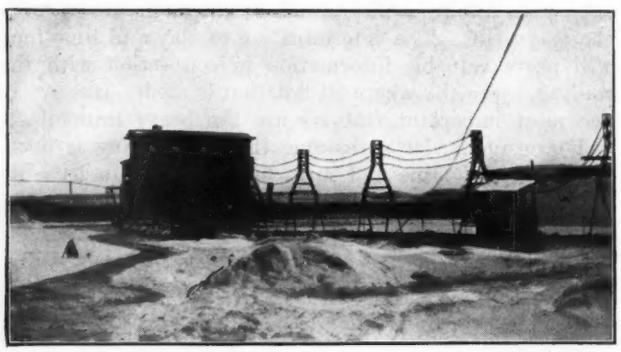
From which it is seen that a profit of only 3.2c. is made from the 2% ore, while a profit of 46.1c. is made from the 1% ore. Of course, these ratios are an exaggerated case, but this table serves to bring out my point that "mineralogical analysis" comes very close in importance to the actual copper assays, especially where a company is dependent upon an outside smeltery.

C. & H. Suction Dredge in Winter

By C. H. Benedict*

The Calumet & Hecla Mining Co. is reclaiming its conglomerate tailings by dredging.[1] Last winter being the first during which the dredge operated, there were presented some unusual problems due to the severe weather conditions. The tailings lie in Torch Lake, a body of water about four miles long and three-quarters of a mile wide, and they extend to a depth of 100 ft.

The tailings are picked up by a 20-in. Bucyrus hydraulic dredge and are conveyed through a ponton line to a central reservoir near the original shore line. A centrally pivoted bridge, carrying a pump-suction pipe, swings over this reservoir and a 12-in. Morris pump lifts the sands



STERN VIEW, C. & H. SUCTION DREDGE, AND PONTON LINE, TORCH LAKE, MICH.

and delivers them to a classifying house and regrinding plant for further treatment.

The problem was to keep the suction dredge operating throughout the winter, which was a particularly severe one. Freezing temperature set in by Dec. 1, and from Jan. 1 to Feb. 15 there was almost continuous storm, some snow falling every day for 45 days. Much of the time the temperature was below zero, and as late as Mar. 17 a temperature of 25° below was recorded. Ice conditions began to get bad about Jan. 1; before that time it was easy to cope with the ice by simple means. It was necessary to keep the 600-ft. ponton line free to swing at all times, but the dredge itself with its powerful suction ladder and steel hull managed to break the ice fairly well. In January, the ice having reached a thickness of 8 in., dynamite was resorted to in order to keep the pontons clear. This worked admirably for a few days, but trouble multiplied fast, for the ice broken up one day would form hummocks and make the next day's work all the more difficult. It soon became evident that the ice would have to be removed as fast as formed in order to keep the pontons clear. On account of the depth of sand, the dredge moved but little from day to day, so that the area to be kept clear was not great.. The ice was sawed every morning along the pontons and a channel about 10 ft. wide was kept open between the dredge and shore. On the shore was a boom used for stacking logs, and the cakes of ice as sawed were floated through the channel and stacked on shore. It was possible to keep open water about the dredge itself by using an auxiliary water pump and playing large streams along the hull, the agitation both preventing freezing and breaking up ice already formed. There was no serious trouble experienced from freezing either on the suction or discharge lines, and fortunately not a single rubble sleeve wore out during the winter. The interior of the dredge was kept comfortable by a boiler and heating pipes, and as the suction ladder worked between sliding doors, there was but little exposure from that source.

Since the beginning of operations there have been but two days on which the regrinding plant had to shut down for lack of sand, and the time lost then was due to a broken pipe, the repair of which was complicated by severe weather. The cost of the extra work during January, February and March, due to climatic conditions, was about $40 per day, or 2c. per ton of sand handled and less than ¼c. per pound copper produced. Considering the condition of the copper market, this was no hardship. It is probable that the copper obtained from reclaiming these tailings was as low-cost as any copper put on the market last year.

*Metallurgist, Calumet & Hecla Mining Co., Calumet, Mich.
[1]"Eng. and Min. Journ.," Nov. 7, 1914.

Mining Machinery as Part of Real Estate

Mining machinery installed by a lessee of mineral lands does not become a part of the real estate, if at the time of installation it is agreed between the parties that it shall remain personalty and may be removed by the lessee, although it be affixed to the soil.

In applying this rule in the case of Cogwill vs. Little Persimmon Mining Co., 183 Southwestern Reporter, 346, the Springfield, Mo., Court of Appeals decided that, under a lease giving the lessee a reasonable time within which to remove a mill and machinery on termination of the lease, there was no forfeiture of the property to the lessor through failure to remove it within sixty days after the lessor forfeited the lease, although the lessor gave notice to remove within that time, the removal being effected shortly afterward and the lessor not having been prejudiced through the machinery remaining on the land in the meantime.

Domestic Asbestos Was Marketed in the United States in 1915 to the amount of 1,731 short tons, valued at $76,952, according to the United States Geological Survey. Compared with the production of 1914 this represents a gain of 484 tons, or 39%, in quantity and 306% in value. The asbestos of the world is supplied chiefly by Canada. Most of it is exported free of duty to the United States, the greatest manufacturer and user of asbestos products.

Zinc Distillation After Prereduction

C. A. H. de Saulles, in U. S. Pat. No. 1,183,172, issued May 16, 1916, describes an improvement in the metallurgy of zinc comprising the addition of carbon to the nearly finished charge in the roasting furnace and the regulation of the combustion thereof for the purpose of effecting a reduction of impurities that are prejudicial in the distillation in the retorts. The principal purpose is the reduction of sulphates, especially the sulphates of zinc, lead, barium, calcium and magnesium, the retorts being thereby relieved of the burden of reducing them and there being a correspondingly less production of gases and consequently a less velocity of the gases making exit from the retorts. Magnesium sulphate present in the charge is reduced in the retorts to magnesium sulphide, and the latter, in being further changed to magnesium oxide, gives up its sulphide to the zinc, producing zinc sulphide and thus increasing the loss of zinc. In the prereduced charge the magnesium goes to the retort as oxide, which is harmless in the retort and is even beneficial in that it tends to stiffen the slag therein. Furthermore, ferric oxide is reduced in part to metallic iron, in which form it is of less injurious effect upon the retort than is ferrous oxide.

The Process in Practice

The net result of this procedure is to relieve the retort of a considerable proportion of the burden usually imposed upon it. The process has been in use at the works of the United States Zinc Co. at Blende, Colo., for about two years. It has been found there that the zinc begins to distill from one to two hours earlier than in usual practice and the extraction of zinc in distillation is increased. There is reduction of zinc loss, owing in part to the production of a less quantity of blue powder, which is caused by oxidation of zinc by carbon dioxide and by the reaction of zinc vapor and sulphur dioxide, leading to the formation of a coating of zinc sulphide around the minute droplets of zinc that are being precipitated in the condenser.

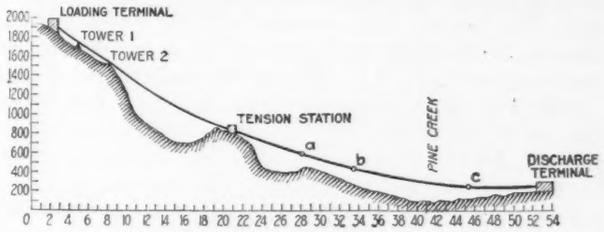
Loss of zinc is also avoided by increasing the life of the retort, which has been raised about six days. The addition of carbon to the roasting ore has thus resulted in an increased recovery of zinc of approximately 6%—that is, an extraction of 80% has been raised to 86%. The consumption of retorts has in some periods been reduced from 1.6 per ton of ore to only 1 retort per ton of ore. No increased loss of zinc in the roasting furnace has been experienced. In carrying out the process, carbon (preferably in the form of fine anthracite) is added to an amount equal to about 8% of the weight of the charge of zinc ore. The temperature due to the combustion of the added carbon must not exceed 1,000° C., and preferably is limited to a maximum of about 880° C.

This process is similar to one that is described by Alex Roitzheim in U. S. Pat. No. 1,100,490, but Roitzheim has a slightly different idea as to the effective and permissible temperature. He advises the preheating at 600° C. and says that at 700° C. a strong reduction of zinc oxide takes place. Roitzheim and de Saulles are in direct conflict on this point, their difference being possibly due to errors in pyrometric determinations.

Aerial Tramway Locked by Windstorm

By Hamilton W. Baker*

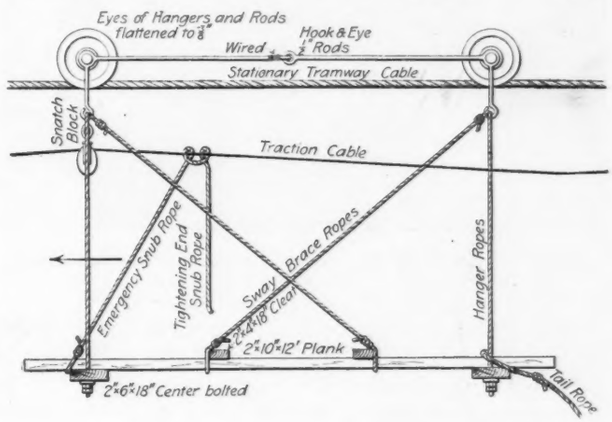
An accident of interest to tramway operators recently occurred on the line of the Baker Mines Co., of Cornucopia, Ore. This company operates a Bleichert tramway of 15 ton per hr. capacity installed by the American Steel and Wire Co. The tramway is 5,500 ft. long and rises



THE BAKER MINES CO.'S AERIAL TRAMWAY

1,675 ft. in this distance. The surface contour necessitated a span of 3,200 ft. from the mill to the first point of support, a tension and anchorage station. I think the span is probably the longest in America.

On Mar. 6 an unusual windstorm arose, necessitating a shutdown for safety. When the storm abated, releasing the band brakes on the bull-wheel at the loading terminal failed to start the tramway. An inspection of the line showed that at a point (*a* on profile sketch) 700



REPAIR RIG FOR THE AERIAL TRAMWAY

ft. below the tension station two buckets, a loaded and an empty, had collided and were apparently locked. From this point to the next empty bucket the traction on the empty side had blown over the loaded stationary cable. At the next empty (*b* on the profile sketch) the loaded stationary cable had blown across the line of the empty and had passed beneath an empty bucket, raised up and was resting on the outside of the bail. From this point to the next span the empty traction had blown over the loaded stationary cable. The next span was clear. At the next, marked *c*, the empty traction had blown across and was resting on the grip lever of a loaded bucket. There was no other apparent trouble, but its correction was accompanied by danger through the necessity of working in snowslide territory where the draws were particularly threatening after a 40-ft. snowfall.

*Mine superintendent, Baker Mines Co., Cornucopia, Ore.

An effort was made to go up from the mill on a raft, but the ascent was too steep. To clear the line it was necessary to make a raft that could be carried by men on snowshoes to the tension station and lowered from there down the line. The tramway foreman rigged up a platform, shown in the accompanying drawing, that met the requirements satisfactorily. Two trolleys were used, and hangers of ½-in. iron were made and fastened to the trolley bearings. A 2x12-in. plank was used for a platform to which rope hangers were dropped from the trolleys. The traction cable was carried from a snatch block fastened to the front trolley, throwing its weight on the iron hangers so as not to increase the strain on the ropes.

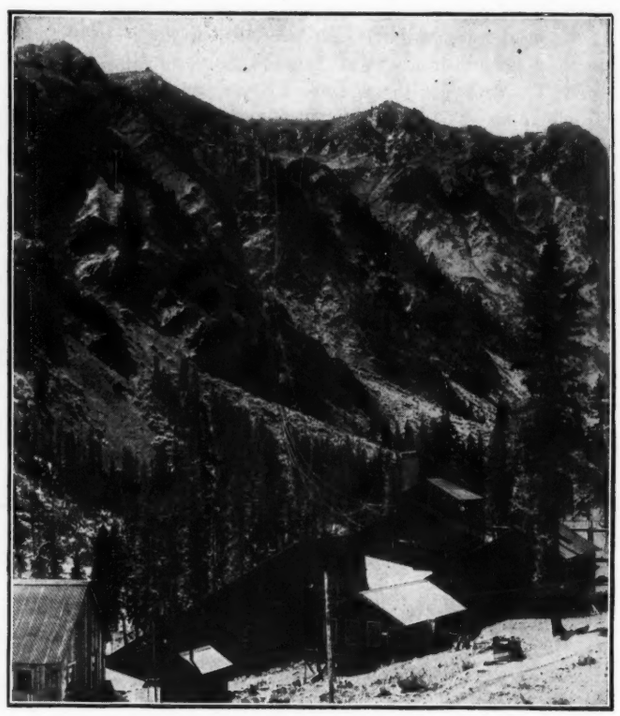
This equipment, a bale of ¾-in. tail rope and extra slings were made into individual packs and carried to the tension station. The rig was there put on the line and the tail-rope snubbed to timbers. The foreman and two helpers mounted the platform and were lowered down the line. To pass the first bucket the following procedure was necessary: A, B and C represent the men, counting from front to back of the rig. As the rig approaches the bucket, the traction cable rises and is thrown out of the

THE TRAVELING PLATFORM FOR REPAIRING THE TRAMWAY

snatch block; A steps to the back of the bail of the bucket; B raises his weight from platform by hanging to stationary cable so that C's weight raises front end to pass above the bucket bail until the front trolley meets the bucket trolley; B then steps to the front of the bail and with A grasps the front trolley of the rig, passing it overhead and placing it ahead of the bucket trolley; A holds it in position while B advances and attaches the guy ropes; B and C advance the platform until the back trolley meets the bucket trolley; A mounts the platform and takes a position out of the way; B and C transpose the trolley and attach the hanger ropes; B and C then mount the platform and are ready to be lowered along the line. This operation requires about three minutes. An emergency rope is fastened to the front end of platform and two half-hitches are taken around the traction cable. By grasping the loose end of this rope the speed may be controlled at will.

At the point of collision of the loaded and empty buckets, they were lashed firmly together and the grip levers of both buckets were lashed down. A hand rope was fastened to the grip lever of the empty and thrown over the stationary cable to the ground. The men were lowered and the lever thrown. The buckets separated sufficiently to allow the empty, on the removal of the lashes, to be slacked to a lower position and gripped. From this point the tail-rope was dropped from the tension station, one end passed through a pulley attached to the bucket and the main rope fastened to a tree on the ground. From this point surface men paid out the rope. From *a* to *b*, shown on the profile drawing, the jar from the separating buckets had thrown the traction away from the stationary cable. At *b*, both stationary cables were lashed together by tying one end of a rope to the lower, or loaded, stationary cable and looping it around the cables several times. The long end was lowered to the ground and handled by two surface men. Tightening on the rope tightened the loops, raising the lower cable above the bucket bail. The bail was dumped and the rope slacked to a point where the cable passed beneath the bucket and back to place.

The remainder of the cable was cleared as the men were lowered by prying the traction cable from the sta-



VIEW OF THE BAKER MINES CO.'S CABLEWAY

tionary, using a hardwood stick. The time required was 27 working hours, using 6 men. A better idea of the strength of the wind may be given by saying that the traction cable rubbed a tree 40 ft. to one side of the line of travel. An analysis of the accident demonstrated conclusively that the 5 to 6 ft. difference in elevation of the stationary cables made this accident possible. It was evident that the accident at *b* shortened the 8-ft. span between the cable lines to such an extent that the collision at *a* and overlaps between *a* and *b*, and *b* and *c*, were made possible. In closing down, a precaution followed is to give the stop signal when loaded and empty buckets are opposite on the line. A severe wind on a tramway so handled might, in an extreme case, wrap a span of traction over the stationary cable, but it is highly probable that the vibration and strains of operation would jar the cable loose.

Cost of Coal and Oil as Fuel

The chart herewith shown, from *Power* of May 30, 1916, should prove valuable to determine the relative value of coal and oil as boiler fuels. The fuel consumer must first have available data to determine the cost for producing a unit quantity of steam in his plant both with coal and with oil. The cost of steam includes fuel, labor, fixed charges and supplies.

The first factor in this comparison is the respective heating value of the two fuels. On account of the variations in heating value of both coal and oil, no definite calorific standards can be stated. In general, fuel oil will contain about 30% more heat units per pound than coal. As the prices for fuel oil are quoted on the basis of a barrel of 42 gal., it is necessary to know the heating value per gallon or barrel. This figure may be determined from the calorific value per pound and the gravity, the latter indicating the number of pounds per gallon.

In comparing the fuel costs of coal and oil, the heating value per unit of price is not the only determining

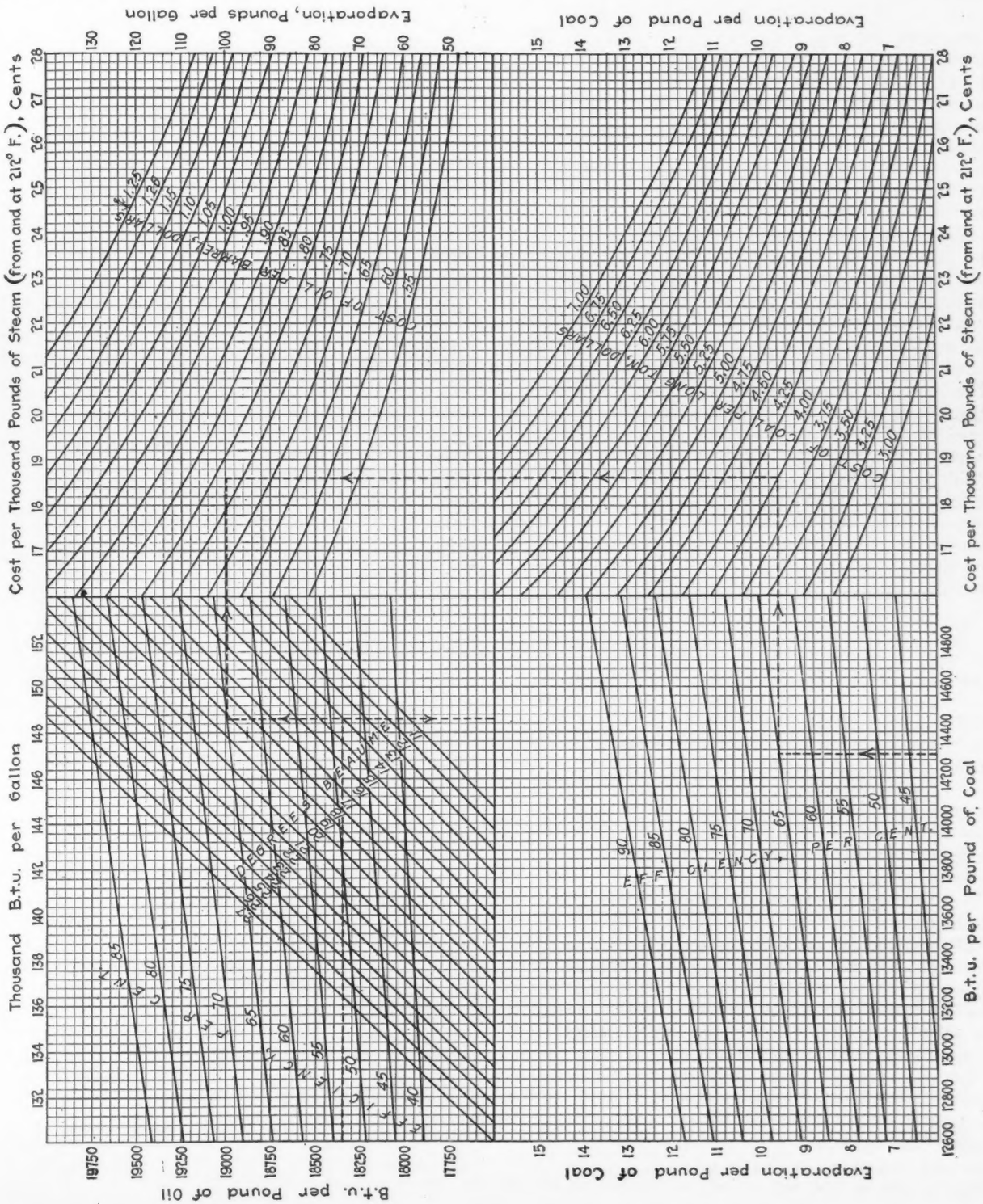

Evaporation, Pounds per Gallon
Evaporation per Pound of Coal
Cost per Thousand Pounds of Steam (from and at 212° F.), Cents
Thousand B.t.u. per Gallon
B.t.u. per Pound of Oil
B.t.u. per Pound of Coal
Evaporation per Pound of Coal
Cost per Thousand Pounds of Steam (from and at 212° F.), Cents
DEGREES BAUMÉ
EFFICIENCY
P.E.R.
C.F.E.

CHART FOR DETERMINING THE COMPARATIVE COST OF COAL AND OIL AS FUEL

factor. The percentage of this heat that can be usefully employed in the generation of steam or the boiler and furnace efficiency is of equal or greater importance. The heat so utilized will vary from 45 to 85% of the calorific value of the fuel, or the losses will total from 15 to 55%.

An excellent graphic representation of the relative costs of fuel for generating steam with coal and oil was presented in the *Engineering and Mining Journal* of Mar. 25, 1916. An extension of these calculations based on comparatively small variations in the gravity of fuel oil is shown in the chart, the use of which may be understood from the dotted lines, assuming the following values:

Coal at $4 per long ton, having a heating value of 14,300 B.t.u. per pound as fired and burned with a boiler and furnace efficiency of 65%; to determine the maximum price per barrel that should be paid for fuel oil with a gravity of 14° Bé (8.10 lb. per gal.), having a heating value of 18,350 B.t.u. per pound and burned with an efficiency of 65%.

The B.t.u. per lb. of coal is found in the lower left-hand section of the chart. This point is projected upward to the intersection with the 65% efficiency line. From this point, in a horizontal line through the evaporation of 9.6 lb., of water from and at 212° F. per pound of coal, the intersection with the curve for coal at $4 per long ton is found. Passing vertically upward from this point, the cost per 1,000 lb. of steam is found at 18.6c. The chart is to be used with the right side as base.

The B.t.u. per pound of oil is in the upper left-hand section of the chart. This is followed horizontally to the intersection with the 14° Bé, line. Passing downward, or upward, the B.t.u. per gallon is 148,600. Projecting this point upward to the intersection with the 65% efficiency line and horizontally through the evaporation per gallon, 99.8 lb., it is found that the intersection with the price of steam as determined for coal, 18.6c. per 1,000 lb., comes at 78c. per bbl of oil, which will represent the equivalent value of this fuel.

Less Labor with Fuel Oil

In most steam plants the amount of labor required will be less with fuel oil than with coal. The saving in labor when oil is used in a plant that formerly burned coal will depend upon the method of handling coal into storage and from storage to the boiler room, the boiler-load conditions, the type of equipment and the efficiency of the men in the fireroom. It is reported that a saving of 80% in labor was effected in the largest oil-burning power plant in New England when this fuel was substituted. [A saving of 64% was effected on a freight steamer by the substitution of oil fuel.—Editor.]

In a hand-fired mill boiler plant of average size, with coal at $4 per long ton, the cost of steam will be about $0.25 per 1,000 lb. This charge is based on an average boiler efficiency of 65%, allowing 12% of the coal fired during day operation for banking and heating at night. The distribution of the total cost will be about as follows, per 1,000 lb. of steam: Fuel, $0.20; labor, $0.03; fixed charges, $0.02; total $0.25.

The reduction in labor in hand-fired plants of less than 2,000-boiler-horsepower capacity will not be much greater than 50%, or $0.015 per 1,000 lb. of steam. It will be noticed that this figure is 6% of the total or 7.5% of the fuel cost. Therefore, with fuel oil at $1 per bbl., an increase in price of 7.5c. will entirely offset the labor saving.

The investment for equipping a coal-fired plant to burn fuel oil depends upon the size and layout of the apparatus in the boiler room. The situation of the plant with respect to the source of fuel-oil supply will have a material effect upon the cost of the installation, since storage tanks constitute a large percentage of the investment. It is estimated that complete equipment will cost $5 to $10 per boiler horsepower. [$10 in the case of the freight steamer.—Editor.] If the cost of this equipment is taken care of in the fixed charges during the life of the fuel-oil contract, which is usually five years, it will represent an addition of 0.7 to 1.4c. to the charge per 1,000 lb. of steam or 3 to 6% of the cost of steam generation.

In considering the relative merits of coal and oil, each boiler plant should carefully determine the efficiency and labor cost while burning coal with the existing equipment and operating conditions. If a change to oil seems advantageous, similar data should be obtained with that fuel before any definite statement can be made regarding the saving to be effected. The figures and conclusions may be based upon fuel costs, labor saving, increased boiler capacity and convenience, but the future prices of oil will in most cases determine the advisability of its use.

Activity in Manganese Mines

There has been increased activity among the manganese mines of the United States during the first six months of 1916. This activity is shown by the operation of new mines, the reopening of old ones and more regular production from those already active. According to D. F. Hewett, of the United States Geological Survey, there is a prospect that the production for the entire year will greatly exceed that for 1915, which was 9,651 tons, the largest since 1901. Several discoveries are reported from Arizona, California, Oregon, Utah and Virginia, and there are new operators in Arkansas, California, New Mexico, Utah and Virginia.

During the first quarter of 1916 the prices of all grades of manganese ore rose rapidly to the highest figures recorded in 30 years. Prices of 60c. to 65c. per unit for ore containing 45 to 50% of manganese and more than 1% of iron were freely offered about Apr. 1, and it is reported that 70c. per unit, or $35 per ton, was paid for several lots. During the second quarter prices remained constant at these figures. Large quantities of Brazilian ore continue to be received, and there is a prospect that the imports will exceed those for 1915, which were the largest on record with the exception of one previous year.

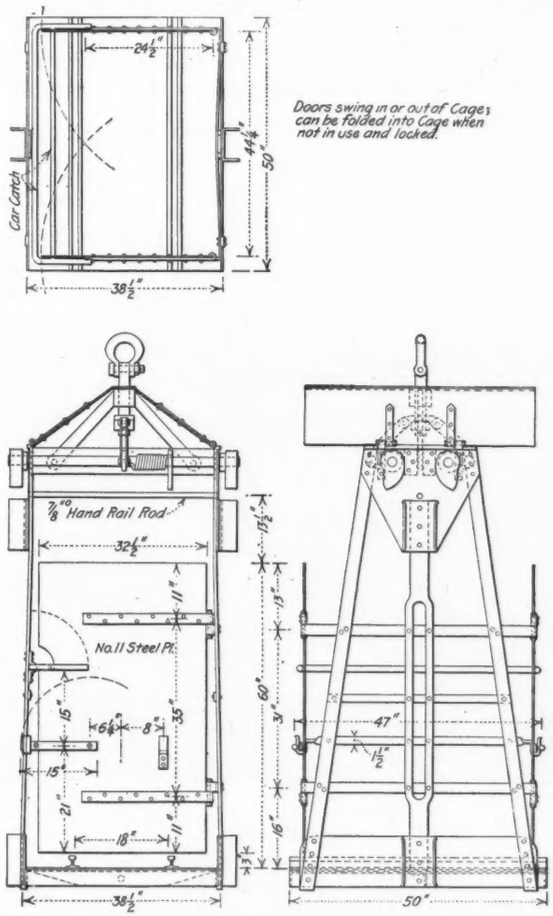
The New York & Honduras Rosario Mining Co., operating at San Juancito, Honduras, shows operating income for the year 1915, of $353,466, from which $54,187 was set aside for depreciation, $59,583 for depletion of ore reserves and $3,600 for fire insurance, leaving a net for dividends of $236,142. From this and the surplus dividends of $240,000 or 12% were paid. There were 117,790 tons of ore treated, which produced 1,749,861 oz. silver and 15,232 oz. gold, which sold for $1,191,761. Other receipts were $8,982. Ore reserves are estimated on Dec. 31, 1915, at 343,716 tons carrying $9.76 per ton, against an estimate of 418,978 tons at $10.45 per ton at the close of 1914. New properties are being looked for in a district about 20 mi. east of the present property, where the government has granted the company prospecting rights covering about 400 sq.mi. This is known as the Chile Mountain concession. The mill extracted 87.45% of the silver and 92.32% of the gold present in the ore. Materials consumed per ton were: Sodium cyanide, 3.93 lb.; lead acetate, 0.211 lb.; lime, 35.5 lb.; tube-mill pebbles, 3.58 lb. and zinc dust, 0.98 lb. Operations are continuing as usual.

Details of Practical Mining

Safety Cage Gates

By Roy F. Smith*

A Colorado law that became effective Apr. 13, 1915, requires that all mine cages shall be equipped with gates. The ones shown in the sketch were designed to be installed on two light cages in use at Leadville, in order to comply with that law. They are constructed of No. 11 steel plate and are hung on hinges made of ⅜x2-in. steel. A ⅜x1½x15-in. latch, which drops into a hook at the side of the cage, holds the gates when in use from swinging in or out of the cage. The car catch may also be lowered when the latch is in place, thus giving additional security in holding the gates from swinging out.



SAFETY-GAGE CAGE

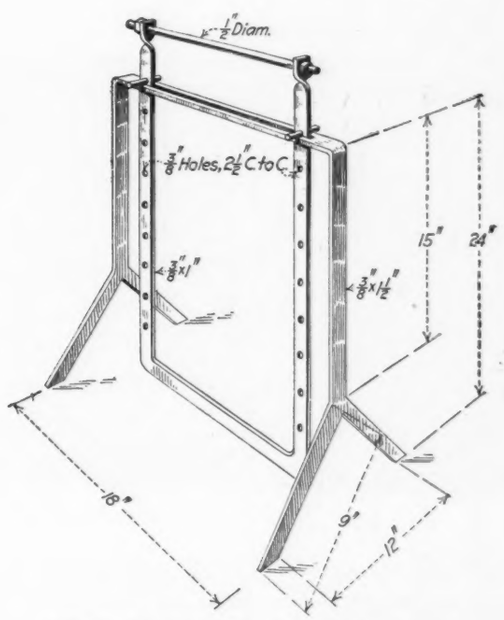
When the cage is to be used for hoisting cars, the gates can be folded one over the other, into the cage, and locked in that position by engaging the latch on one gate in the door hook on the other. With this arrangement the gates in no way interfere with the operation of the car catch or the hoisting of cars and can be quickly swung into place and latched when hoisting or lowering men.

For lowering timber into the mine these doors were found to be safe, convenient and quite a saver of time over the old method of using ropes to hold the timber in the cage. Gates or doors of this type may be readily added to almost any cage, with very few alterations.

*Mining engineer, 1845 Grant St., Denver, Colo.

Steel Rest for Blacksmith Shop

In the accompanying illustration is shown a stand for supporting long steel, rods, etc., in the blacksmith shop when working with them at the forge or anvil. This stand has the advantages over the many "one-legged" forms used, of being more stable and considerably wider, and yet it is simple to construct. The supporting piece is made of ⅜x1½-in. flat iron, the yoke of ⅜x1-in. flat iron. The latter is passed through two slots in the horizontal part of the supporting piece before the ends of the yoke are twisted at right angles, as shown, and the rod passed through these ends. By means of the holes in the vertical members of the yoke and two nails, the support can be held at any desired height.



STEEL REST FOR BLACKSMITH SHOP

When Going Up or Down Ladders in poorly lighted workings it is advisable to hold onto the sides of the ladders rather than the rungs. This will prevent mashed fingers due to the man above stepping on your hands and may prevent a bad fall.

Stockpiling at Pettit Mine

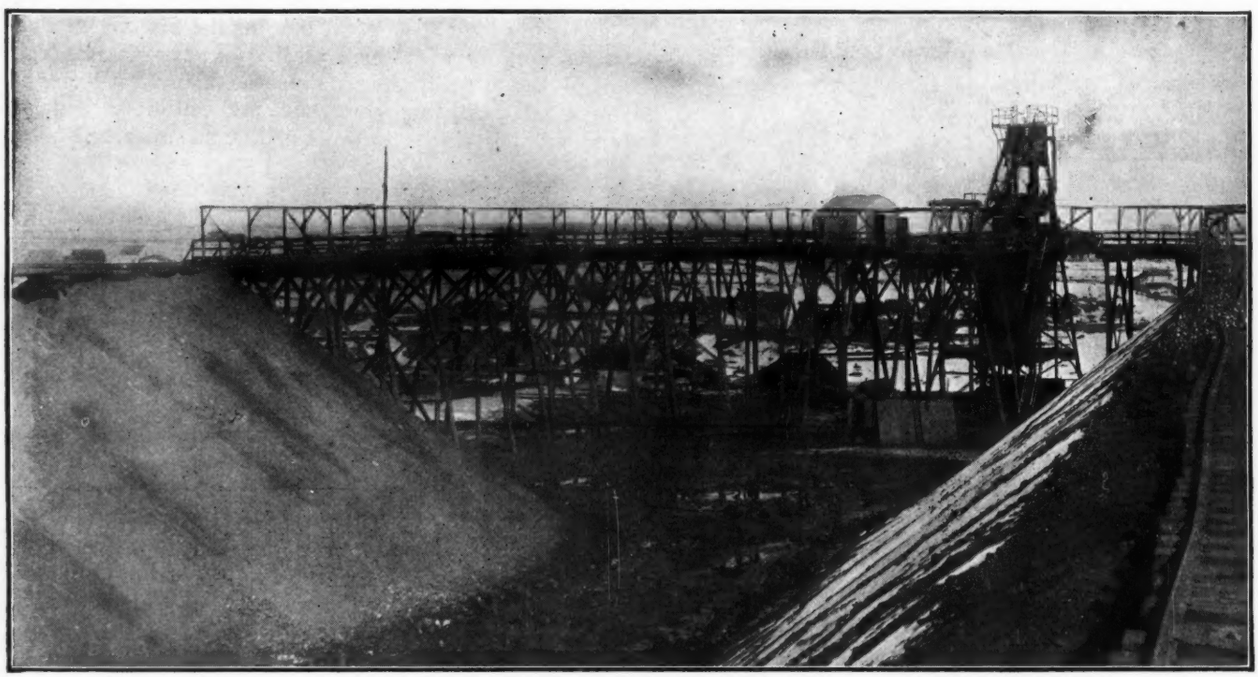
By L. A. Rossman*

One of the problems in connection with the mining of iron ore is its proper storage in stockpiles. Where several kinds are hoisted from a single shaft, this is especially important, not only from the standpoint of quality, but also of efficiency in the disposition of hoisted ore.

Several methods are in use on the Mesabi Range, all of which have interesting features, but one of especial interest is in use at the Pettit mine of the Republic Iron and Steel Co., at Gilbert. The Pettit is an underground property, modern in all details, possessing a steel shafthouse and other good mechanical features. Stockpiling is accomplished essentially as follows:

There are 12 bents of permanent trestle on each side of the headframe, this being necessary to cross the loading tracks and wagon roads. These are of the ordinary three-leg bent type, all floored with two thicknesses of 2-in. plank laid close and equipped with railing and toe-boards. The temporary joins the permanent trestle and consists of two-leg bents, caps, corbels and stringers. The legs are 40 ft. in length, stringers 18 ft., and caps 8 ft. The total height of trestle including caps, corbels, stringers and rail is about 44 ft. The tracks are 36-in. gage without grade, with 30-lb. rails and 3-in. plank ties. In order that two locomotives may operate on the same trestle, a siding is placed on the permanent trestle, this being equipped with automatic-spring switches at either end, allowing the locomotive on the return trip to pass onto the siding without the operator leaving the motor.

The ore is dumped from the skip into a 6-ton gable-bottomed car which is propelled by a 6-ton electric locomotive. The car is dumped by a tripping lever passing over a block set between the two rails and is closed again by returning over the block. With this arrangement two men and one motor have handled an average of 700 tons on each 8-hr. shift with no delay during the winter season.



STOCKPILE AND TRESTLE AT PETTIT MINE

*Grand Rapids, Minn.

A Simple Method of Timber Preservation

By L. B. Reifsneider*

It is a well-known fact that climatic conditions in the tropics are deleterious to all classes of timber structures except those built of native hardwoods. In many places the latter cannot be procured or are obtainable only at prohibitive prices. Imported pine is most commonly used for all construction. In recent years nearly all the ordinary grades imported have been cut from timber that has previously been treated for the extraction of pine-tar products, and this class of timber has been found especially liable to decay.

At very few places are treatment plants available, and a variety of methods of surface treatment have been tried with limited success. About three years ago the following method of treatment was inaugurated at a plant in Cuba, and it has been found to be successful. A tank of 3-in. plank, long enough to contain the longest pieces generally used in the mine structures and large enough to take 6 pieces of 10x10-in. timber, was constructed, and the seams were calked with oakum and tar to make the tank water-tight. A ½-in. pipe line for live steam was run from a shop boiler and connected to the center of the bottom of the tank. A water line was run to the tank for convenience in filling. The timber to be treated was placed in the tank and enough water run in to cover it, the timber being kept from floating by wedging it down under a removable tie-rod. The amount of water in the tank was then computed and chloride of zinc in the ratio

*33 South Third St., Camden, N. J.

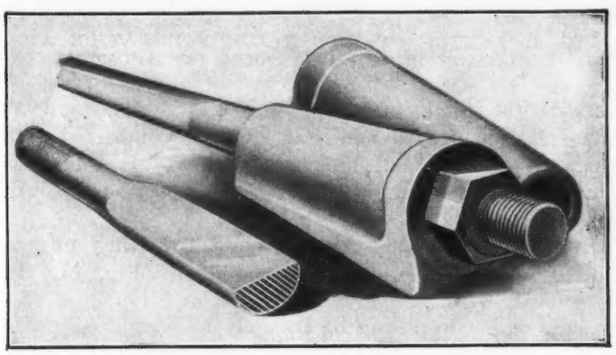
of ½ lb. per gallon of water was dumped into the tank directly over the outlet of the steam line. Live steam was then turned on by opening the ½-in. valve, and the water was allowed to come to the boiling point. The solution was kept at that temperature for from 3½ to 4 hr., and the steam was then turned off and the solution allowed to cool for 7 to 8 hr. for each lot treated. When fresh timber was put in, the solution was strengthened by adding chloride at the rate of about ¼ lb. per gallon of solution to replace that absorbed by the previous treatment. It has been found that it rarely all dissolves at once, but is taken up slowly.

A small derrick and timber dogs are used to remove the timbers from the solution, as the latter, even when cool, is very irritating to the skin, although when dry there are no ill effects from handling the timber. All timber is framed and cut to length before being placed in the tank, so that no untreated surface is left exposed by framing later. Careful observation showed a penetration of the chloride in sapwood and fiber of ¼ to ½ in. and in heart from $\frac{1}{16}$ to ⅛ in., and even after long exposure to torrential tropical rains, the fibers under the surface skin are found intact.

As a test, when the treatment was first started, several sticks of timber were cut and framed into sets for underground work and the parts of the same sticks were carefully marked. Half of the pieces were treated and the rest left untreated, and all were installed on 4-ft. centers in a drive where conditions in respect to moisture and ventilation were particularly bad. Six months after being placed fungus and rot began to appear on the untreated sets, and at the end of 18 months all had been changed and found to be rotten almost throughout. The treated timber is still in place and apparently sound after 38 months, with no signs of fungus. On the surface the results have been equally satisfactory, and all new timber used in any permanent structure is treated after framing.

Half-Round Tank Hoops

Tank hoops of half-round section brought out recently by the United States Wind Engine and Tank Co., of Batavia, Ill., are shown herewith. This section has a

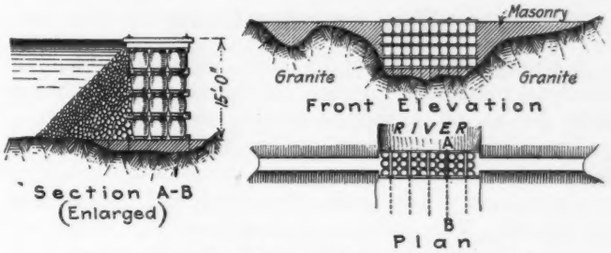


HALF-ROUND HOOPS FOR TANKS

smaller exposed surface than the ordinary wide flat band, and it does not crush the wood or form a dust-collecting gutter (to start corrosion) like a round rod. The lugs keep the ends of the hoops clear of the tank, so that they will not injure the wood. Hoops of this design seem to have advantages that recommend their use.

An Oil-Barrel Dam

A dam made of oil barrels built in northern Nigeria to help form a flotation pool for dredging operations, is described in a paper before the Institution of Mining and Metallurgy, by H. E. Nicholls and in *Engineering News,* June 3. The dam is 15 ft. high and is formed of 120 of the steel barrels in which oil fuel is brought to the site. Other suitable dam materials are very scarce. The barrels are arranged as shown in the sketch and are filled with sand to give weight. They are tied together with timber plates, filled in between with broken granite and tied back upstream with slanting steel tie-rods. The upstream side of the dam is backed with broken rock, the filling being graduated in size from coarse rock next to the barrels to fine rock and finally sand and earth.



STEEL OIL BARRELS FORM CORE OF DAM

Drainage-Ditch Design Tables

Hydraulic tables for use in designing systems of drainage ditches have been prepared by John C. Burke, civil engineer, of Bemidji, Minn., and published in *Engineering News,* June 8. The tables have been found very convenient in the rapid checking of ditch dimensions and the control of velocity. Quantities for Elliott's formula and for two coefficients of Kutter's formula are given to afford ready comparison with other designs.

HYDRAULIC TABLES FOR DRAINAGE-DITCH WORK

Base	Depth	Top	Area	Wet. Perimeter	Hyd. Radius	Grade, %	Velocity, Kutter's 0.025	Velocity, Kutter's 0.030	Discharge, Ell.	Sec.-Ft. 0.025	Sec.-Ft. 0.030	Cu.Yd per Mi.
4	3	10	21	12.5	1.7	0.02	1.2	1.0	34	25	21	4,107
..	..	..	..	....	...	0.04	1.7	1.3	46	36	27	....
..	..	..	..	....	...	0.06	2.1	1.7	54	44	36	....
..	..	..	..	....	...	0.08	2.4	1.9	64	50	40	....
..	..	..	..	....	...	0.10	2.7	2.2	77	57	46	....
4	4	12	32	15.3	2.1	0.02	1.4	1.1	58	45	35	6,258
..	..	..	..	....	...	0.04	1.9	1.6	82	61	51	....
..	..	..	..	....	...	0.06	2.4	1.9	98	77	61	....
..	..	..	..	....	...	0.08	2.8	2.2	114	90	70	....
..	..	..	..	....	...	0.10	3.2	2.5	130	102	80	....
4	5	14	45	18.2	2.5	0.02	1.5	1.3	90	68	59	8,800
..	..	..	..	....	...	0.04	2.2	1.8	130	99	81	....
..	..	..	..	....	...	0.06	2.8	2.2	160	126	99	....
..	..	..	..	....	...	0.08	3.2	2.5	180	144	113	....
..	..	..	..	....	...	0.10	3.5	2.8	200	156	126	....
4	6	16	60	21.0	2.9	0.02	1.7	1.4	130	102	84	11,740
..	..	..	..	....	...	0.04	2.4	2.0	180	144	120	....
..	..	..	..	....	...	0.06	3.0	2.5	220	180	150	....
..	..	..	..	....	...	0.08	3.4	2.8	255	204	168	....
..	..	..	..	....	...	0.10	3.9	3.2	285	234	192	....
4	7	18	77	23.0	3.2	0.02	1.8	1.5	175	139	115	15,060
..	..	..	..	....	...	0.04	2.6	2.2	240	200	169	....
..	..	..	..	....	...	0.06	3.2	2.6	300	246	200	....
..	..	..	..	....	...	0.08	3.7	3.0	350	285	231	....
..	..	..	..	....	...	0.10	4.1	3.3	390	316	254	....
4	8	20	96	26.6	3.6	0.02	2.0	1.7	225	192	163	18,780
..	..	..	..	....	...	0.04	2.8	2.4	320	269	230	....
..	..	..	..	....	...	0.06	3.5	2.9	390	336	278	....
..	..	..	..	....	...	0.08	4.0	3.3	450	384	317	....
..	..	..	..	....	...	0.10	4.5	3.7	508	432	355	....
4	9	22	117	29.4	4.0	0.02	2.2	1.8	293	257	211	22,890
..	..	..	..	....	...	0.04	3.1	2.5	415	363	292	....
..	..	..	..	....	...	0.06	3.8	3.1	510	444	363	....
..	..	..	..	....	...	0.08	4.4	3.5	590	514	409	....
..	..	..	..	....	...	0.10	4.9	4.0	660	573	468	....

The figures at the right, giving the cubic yards of excavation per mile of ditch of given size, serve as a useful check on selected sizes and grades with regard to economy in first cost of system.

Details of Milling and Smelting

New Process for Copper Concentrating

A United States Patent 1,175,331, dated Mar. 14, 1916, has been granted to Richard M. Atwater, Jr., of Scarsdale, N. Y., on a process for concentrating copper.

According to this invention the sulphuric acid is applied to the tailings as they lie on the ground, sprinkling the acid, in a suitable state of dilution and in a limited volume, over their surfaces at intervals of time dependent upon the depth, the consistency, the metal contents and especially upon the state of the weather. The exact amount of acid for any given case is best determined by experiment. The dryness of the climate and consequent strong evaporation of moisture from the earth's surface causes the copper sulphate formed from the diluted sulphuric acid to rise to the surface by capillary attraction and to form, by a sort of efflorescent attraction, a crust of impure copper sulphate, which is removed by any suitable mechanical means, such as scrapers, and carried to a central point, where it may be further washed or treated or refined before selling.

A practical manner of carrying out this method of copper concentration consists in leveling and blocking out the tailings heaps by means of a plow and scraper, in much the same way as truck farms are laid out and then running a light industrial-railway track around the blocks thus produced, to facilitate the transport of the acid and of the concentrated product formed by the treatment. The acid is carried in suitable containers run alongside the plot to be sprinkled and is conveniently applied with a hose, care being taken not to disturb the plane surface more than is necessary. As soon as the crust has formed sufficiently, which may take from, say, one to ten days according to the weather, it is removed by hand, preferably using scrapers. The heaps of concentrates, after being scraped together, are loaded on cars and run to the central plant. Here the concentrates can be placed in tanks when desired and redissolved, the residue being chiefly sand. The copper may then be extracted by suitable reagents, by electrolysis, or by evaporation.

Acid-Proof Mortar should be used in the construction of dust flues where the gases are liable to contain much SO_3. J. Moore Samuel, in the June "Bulletin" of the American Institute of Mining Engineers, says that the dust-chamber walls of the roaster department of the Copper Queen works at Douglas, Ariz., were constructed of hollow tile laid in cement mortar. The conversion of the calcium carbonate in the mortar into calcium sulphate by the sulphur trioxide in the gases caused a volume change that shattered the tile. This resulted in a large leakage of air through the walls of the chamber, this "false air" constituting approximately one-third of the total volume of flue gases. The walls are being repaired, the damaged sections being replaced by new tile laid with a fire- and acid-proof mortar. A considerable reduction in the dust loss is anticipated from the decreased volume moving through the chamber at a proportionately reduced velocity; it is found in practice that the roaster draft has a great effect on the capacity of the furnaces, but tests also show that increase of draft, or increase of tonnage treated, result in prohibitive dust losses, so that now the roaster draft is kept at the absolute minimum required to carry away the gases.

Difficult Chimney Foundation Tested After Completion*

A load test was recently made on a new chimney foundation of unusual design in Pittsburgh. The test confirmed the engineers' judgment by showing that the foundation is amply safe under the intended loading.

In modernizing the boiler plant at the Brilliant pumping station, the city's Bureau of Water encountered a difficult problem in the design of foundations for two new steel chimneys 10x200 ft., since the soil is filled ground along the bank of the Allegheny River. Test borings showed that the subsoil fill consisted of well-compacted broken stone and shale mixed with red clay and a small quantity of gravel.

A test pit sunk to the level of the contemplated base of the foundation was loaded with a concentrated test load of 5,500 lb. per sq.ft. Immediately upon the complete application of this load a settlement of 0.028 ft. occurred in 20 min., at the end of which time movement

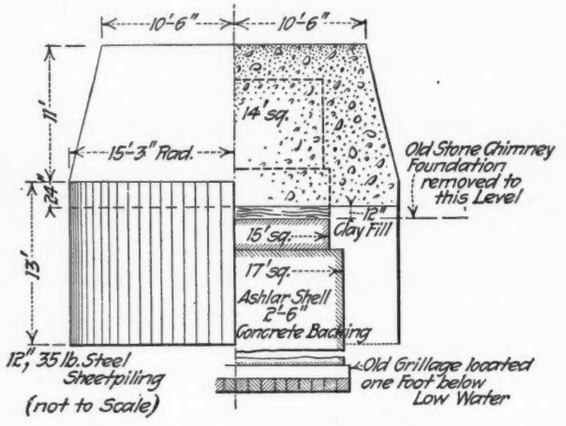


FIG. 1. SKETCH OF NEW STACK FOUNDATION AT BRILLIANT PUMPING STATION, PITTSBURGH

ceased; the total settlement was 0.145. The soil at the elevation loaded consisted of well compacted soft shale, clay and small broken sandstone. It was concluded that a maximum load of 2½ tons per sq.ft. could be applied with safety.

Accordingly a mass-concrete spread footing unsupported by grillage was determined upon (Fig. 1). It is conical, with base area 730 sq.ft. and top area 346 sq.ft., the height being 13 ft. and the weight approximately 500 tons. The new stack comes directly over the site of the old stack, which was built with an ashlar foundation supported on timber grillage. The old base was removed to a point 1 ft. below the level of the bottom of the new foundation block, and clay placed between the top of the old base and the bottom of the new, to prevent unequal distribution of the load over the bottom of the new block. As the elevation of the bot-

*"Eng. News," June 15, 1916.

tom of the foundation is below flood stage in the river a ring of steel sheetpiling was driven around the footing to a point 11 ft. below the base, to prevent scour due to fluctuation of water level.

The foundation block was poured as a monolith, without interruption of the work from start to finish. The completed base was subjected to a loading of 1.6 tons per sq.ft. (including weight of base). This is about equal to the dead-load of the structure. A platform was built up, using four 15-in. I-beams 25 ft. long directly on the top of the foundation, crossing these with six 15-in. I-beams and three 12x14-in. timbers, and laying on this a floor about 25 ft. square. The materials used for loading consisted of 340 tons of dressed sandstone, available on the ground, and sufficient sacked gravel and cement to make the total load, together with 8 tons in grillage and platform, 680 tons, making a live-load of about 0.9 tons per sq.ft.

The load was applied uniformly over the entire platform. Levels were taken from time to time on the tops of four ¾-in. steel pins, one at each end of two 20-ft. diameters, 90° apart, whose elevation had been determined prior to the application of the load. They showed that an average settlement of 0.0055 ft. occurred during a lapse of five days, due to the weight of the completed foundation alone, which gave a pressure of 0.7 tons per sq.ft. By the time the test load was placed an average settlement of 0.028 ft. had occurred. An additional settlement of 0.004 ft. took place during the ensuing two days, making a total average settlement of 0.032 ft. under the full loading of 1.6 tons per sq.ft. Levels taken as loading was removed showed no reaction. Work is done under supervision of C. A. Finley, managing engineer, and C. O. Daughaday, mechanical superintendent.

FIG. 2. ONE OF THE NEW CHIMNEY BASES AT BRILLIANT STATION

FIG. 3. TEST LOAD OF 680 TONS ON CHIMNEY BASE; ⅜-IN. SETTLEMENT

⁂

Improving the Physical Properties of Zinc—E. H. Schultz, Chem. Ztg. 39, 547 (1915), in a lecture before the Ges. deut. Metallhütten-u. Bergleute states that the addition of about 6% Cu and 3% Al increases markedly the hardness and toughness of cast Zn. It also produces a more homogenous metal which contracts but slightly on cooling. Pressing or rolling improves the qualities of Zn.

Recovering Elemental Sulphur from Sulphur Dioxide

The recovery of elemental sulphur from furnace gases containing sulphur dioxide has been patented by William F. Lamoreaux of Isabella, Tenn., in U. S. Pat. 1,182,915, supplementing the Lamoreaux and Renwick patent of May 18, 1915, (U. S. Pat. 1,140,310) and the Lamoreaux application of Feb. 9, 1915, (Serial No. 6909). These prior applications covered a method of reducing sulphur dioxide from furnace gases by keeping the gases in contact with incandescent carbon for a predetermined period and supplying the additional heat necessary to secure practically complete reduction to elemental sulphur from a source independent of the oxidation of said carbon; this increment of heat might be supplied by passing an electric current through the carbon bed, or by initially preheating the gas to a sufficiently high degree to compensate for the deficiency of temperature resulting from dissipation of heat from endothermic reactions, radiation and other losses in the reaction zone; preheating was also provided by utilizing the heat otherwise wasted in the gases issuing from the furnace and eventually the sulphur was precipitated in suitable condensers. The coke or charcoal bed was consumed and had to be repaced according to the amount of oxygen contained in the furnace gases.

The present patent provides for the introduction of a suitable reducing gas or vapor, such as atomized oil, and effecting the practically complete reduction of the sulphur dioxide without any appreciable consumption of the incandescent carbon bed through which the gases are made to pass. Thus the reduction is accomplished by the fluid reducing agent and the bed of incandescent carbon serves the practical purpose of insuring an intimate mixture of the reducing agent and the sulphur-bearing gases; further the coke also serves as a conducting and heating medium when it becomes desirable to employ the electric current for adding extraneous heat. Delicate and positive control of the feeding of the reducing agent and the avoidance of blow-holes in the carbon bed are thus attained.

The Cost of Doing Things

Cost at Nipissing Low-Grade Mill

The high-grade mill of the Nipissing Mining Co., Cobalt, treated 921 tons of 2,474-oz. ore and 553 tons of custom ore averaging 2,917 oz. per ton. The low-grade mill treated 77,183 tons averaging 31.49 oz. silver per ton, and crushed 262.82 tons per day giving a stamp duty of 6.57 tons. The table shows the cost of milling the low-grade ore:

COSTS AT NIPISSING LOW-GRADE MILL

	Cost per Ton
Crushing at mine	$0.156
Aerial tramway	.064
Surface tramway	.060
Picking plant	.184
Crushing and conveying	.051
Battery	.295
Tube mills and classifiers	.649
Desulphurizing and slime collecting	.190
Intermediate filtering	.084
Cyanide filter	.126
Clarifying and precipitation	.378
Refining	.103
Heating	.110
Water supply	.037
Construction	.017
Residue dam	.062
Consulting	.052
Cyanide treatment	1.295
	$3.913

Consumption of Supplies at Low-Grade Mill

	Total, Lb.	Cost Per Lb.	Pounds Per Ton	Cost Per Ton
Sodium cyanide	329,600	$0.2240	4.270	$0.9564
Lime	378,680	.0040	4.905	.0198
Caustic soda	213,144	.0284	2.760	.0785
Aluminum dust	51.040	.4210	.660	.2784
Aluminum plates	8,140	.2364	.106	.0249
Aluminum ingots	4,257	.2104	.055	.0117
Pebbles	400,675	.0090	5.190	.0466
Coal	2,102,000	.0029	27.234	.0788
Borax	6,305	.0456	.086	.0037
Power per kw.-hr.	4,922,400	.0[illegible]7	63.776	.7476
				$2.2464

Milling Costs at Goldfield

The Goldfield Consolidated Mines Co., Goldfield, Nev., in its report of operations in 1915, has compiled a number of tables of interest and value to operating engineers.

TABLE 1. INDIVIDUAL ITEMS CONSTITUTING CONCENTRATE-TREATMENT EXPENSE

Item	Quantity	Price per Unit	Quantity per Ton Concen.	Cost per Ton Concen.
Cyanide	130,972 lb.	$0.17497	5.76 lb.	$1.008
Zinc dust	15,235 lb.	.10951	0.67 lb.	.073
Lime	720,200 lb.	.00669	31.67 lb.	.212
Lead acetate	10,535 lb.	.09115	0.46 lb.	.042
Water	31,159,474 gal.	.15984	1,370.19 gal.	.219
Fuel oil	327,153 gal.	.03794	14.39 gal.	.546
Sulphuric acid	134,400 lb.	.02399	5.91 lb.	.142
Muriatic acid	2,497 lb.	.04606	0.11 lb.	.005
Assaying				.027
Roaster parts				.027
Machinery and repairs				.015
Belting				.009
Lubrication				.017
Borax	135 lb.	.11911	0.01 lb.	.001
Litharge	7,751 lb.	.07567	0.34 lb.	.025
Coke	9,900 lb.	.00725	0.44 lb.	.003
Pig lead	2,560 lb.	.05845	0.11 lb.	.006
Slag	2,415 lb.	.0073	0.11 lb.	.001
Filter cloth				.020
Pipe and fittings				.033
General stores				.036
Pump parts				.015
Iron ore	4,354 lb.	.009	0.19 lb.	.002
Total supplies				$2.484
Operating labor	3,852 shifts	4.282	0.169 sh.	.726
Repair labor	517 sh.	4.453	0.023 sh.	.101
Power	252 hp.	72.00	4.045 hp.	.798
Total				$4.109

TABLE 2. SEGREGATION OF MILLING COSTS Per Ton of Ore Milled

Department	Labor	Supplies	Power	Total	Per Cent. Total
Crushing and conveying	$0.020	$0.007	$0.007	$0.034	2.40
Stamping	.028	.039	.059	.126	8.91
Chilean milling	.015	.032	.041	.088	6.22
Elevating and classifying	.011	.003	.005	.019	1.34
Tube milling	.020	.062	.091	.173	12.23
Concentration	.025	.009	.014	.048	3.39
Neutralizing	.006	.072	....	.078	5.52
Settling	.012	.071	....	.083	5.87
Dissolution	.017	.355	.031	.403	28.50
Filtering	.028	.018	.012	.058	4.10
Tailing expense	.001	....	....	.001	0.07
Assaying	.002	.012	....	.014	0.99
Precipitation	.007	.044	.011	.062	4.38
Refining	.016	.021	....	.037	2.62
Water	....	.039	....	.039	2.76
Surface and plant	.004	.003	....	.007	0.50
Steam heating	....	.002	....	.002	0.15
Storehouse and office	.008	.001	....	.009	0.64
Stable	.001	.001	....	.002	0.15
Watchmen	.019	....	....	.019	1.34
Superintendence and foremen	.034	....	....	.034	2.40
Lighting	.001	.002	.013	.016	1.13
General expense	.001	.005	.001	.007	0.50
Mill tools	.001	.004	....	.005	0.35
Electrical department	.004	.015	....	.019	1.34
Pumping battery water	.006	.003	.013	.022	1.56
Experimental	.005	.004	....	.009	0.64
Totals	$0.292	$0.824	$0.298	$1.414	100.00
Per cent. of total cost of milling	20.65	58.27	21.08	100.00	
Per cent. of combined cost of milling and concentrate treatment	17.63	49.76	18.00	85.39	

TABLE 3. INDIVIDUAL ITEMS CONSTITUTING MILLING EXPENSE

Item	Quantity	Price per Unit	Quantity per Ton Concen.	Cost per Ton Concen.
Cyanide	622,931 lb.	$0.17566	1.61 lb.	$0.284
Zinc dust	137,106 lb.	.10952	0.36 lb.	.039
Lime	8,225,140 lb.	.00665	21.31 lb.	.142
Lead acetate	243,645 lb.	.09072	0.63 lb.	.057
Muriatic acid	76,331 lb.	.04746	0.20 lb.	.009
Water	93,478,014 gal.	.15984	242.23 gal.	.039
Lubrication				.006
Borax	1,215 lb.	.11816	0.003 lb.	....
Litharge	101,730 lb.	.07764	0.26 lb.	.020
Pig lead	23,040 lb.	.05845	0.06 lb.	.004
Shoes and dies	185,249 lb.	.05263	0.48 lb.	.025
Pebbles, flint	1,039,302 lb.	.01545	2 69 lb.	.042
Pebbles, rock	422,750 lb.		1.09 lb.	....
Tube-mill linings	91,795 lb.	.06222	0.24 lb.	.015
Chilean steel	127,296 lb.	.06541	0.33 lb.	.022
Machinery and repairs				.015
Screens				.004
Office supplies				.001
Filter cloth				.007
Iron and steel				.010
Assaying				.013
Hose and fittings				.001
Pipe and fittings				.004
Lumber				.004
Crusher parts				.004
Coal	70 tons	15.0543	0.36 lb.	.003
Coke	89,100 lb.	.00725	0.23 lb.	.002
Slag	21,735 lb.	.00731	0.06 lb.	....
Pump parts				.006
Waste	2,990 lb.	.11401	0.01 lb.	.002
Electrical operation and repair				.014
General stores				.020
Fuel oil	28,425 gal.	.0378	0.07 gal.	.003
Iron ore	39,187 lb.	.009	0.10 lb.	.001
Belting				.006
Total supplies				$0.824
Operating labor	18,142 shifts	4.566	0.047 sh.	.215
Repair labor	6,526 sh.	4.572	0.017 sh.	.077
Power	1,600 hp.	72.00	1.513 hp.	.298
Total				$1.414

The consumption of material of all kinds is given in considerable detail, and costs are shown with great accuracy.

The mill operated at its maximum efficiency and averaged 1,057 tons per day. This is a higher daily average by 110 tons than for any other year in its history. An average recovery of 90.45 % was made, which in view of the low-grade ore treated, is to be considered good work.

The costs were the lowest that have ever been achieved here and, compared with the previous year, show a reduction of 22c. per ton. The reduction is attributable to increased tonnage, reduction in the consumption of chemicals and

TABLE 4. SEGREGATION OF CONCENTRATE-TREATMENT COSTS
Per Ton of Concentrate Treated

Department	Labor	Supplies	Power	Total	Per Cent. Total
Raw cyanidation	$0.076	$0.385	$0.179	$0.640	15.58
Filtering and conveying	.170	.035	.041	.246	5.99
Roasting	.280	.589	.112	.981	23 87
Acid treatment	.069	.161	.239	.469	11.41
Cyanidation of roasted product	.091	.917	.197	1.205	29.33
Assaying	.012	.026	....	.038	0.92
Precipitation of copper	.055	.044	....	.059	1.44
Precipitation	.015	.083	.020	.118	2.87
Refining	.030	.040	....	.070	1.70
Disposal of tailings	.026	.016	.010	.052	1.27
General expense	.003	.009	....	.012	0.29
Water	....	.219	....	.219	5.33
Totals per ton of concentrate	$0.827	$2.484	$0.798	$4.109	100.00
Totals per ton of ore	.049	.146	.047	.242	
Per cent. of total cost of concentrate treatment.	20.13	60.45	19.42	100.00	
Per cent. of combined cost of milling and concentrate treatment.	2.96	8.81	2.84	14.61	

in the cost of power through more accurate regulation of the peaks with a correspondingly higher power factor.

The accompanying tables give a full and clear account of the milling work done and the results obtained.

The Tonopah Belmont Mill

The milling plant of the Tonopah Belmont Development Co., at Tonopah, Nev., treated 165,157 dry tons of ore during 1915, an average of about 452 tons per day. This ore contained a total of 32,348.289 oz. of gold and 3,237,602 oz. of silver, an average grade of 0.196 oz. of gold and 19.603 oz. of silver per ton. Average value was $13.88 per ton. The gross value was $2,292,943, calculating silver in bullion at 50c. per oz. The average per-ton value was lower than that of the previous year by $2.838, or about 17%. The average recovery was 96.18% of the gold and 91.69% of the silver contents; a combined extraction of 92.97%.

The average number of stamps dropped was 50, out of a total of 60, and the average 24-hr. duty per stamp was 9.15 tons. The daily average tonnage for the 361 days of actual operation was 457.5 tons.

The average direct milling cost was $2.366 per ton, 21c. per ton higher than the similar cost for the preceding year. The indirect cost for milling was $0.316 per ton, a little less than 1c. lower than the previous year's similar cost. The average total milling cost was $2.682, or $0.118 higher than the similar cost for the previous year. The direct cost of production of the unit ounce of doré bullion was $0.13. The higher cost per ton and per ounce of metals produced was due in part to the lower tonnage handled, but chiefly to the increased cost of chemicals and other supplies. Thus the increased direct milling cost was almost wholly due to advances in prices. The consumption costs of cyanide, lead acetate, zinc dust and grinding pebbles account for over 18c. of the increase.

The only change in filtering equipment or process is in the adoption of a new style of filter leaf with which, after fair tests, the mill has been equipped. The new leaf is cheaper as to first cost than those previously used and has a further and greater advantage of more thorough washing, by which the soluble losses have been reduced by nearly one-half. The Belmont tube-mill liners, installed during the previous year have proved satisfactory, this equipment having reduced the tube-mill cost, as compared with silex lining, by nearly 3.5c. per ton of ore ground. The accompanying table shows the segregated costs of milling at the Tonopah plant.

The Millers plant was operated throughout the year as a custom mill, treating 56,735 tons of custom ore of an average per ton content of 0.309 oz. of gold and 25.01 oz. of silver, having a gross value of $1,730,516. Recoveries of 93.75% of the gold and 40.13% of the silver were made, the combined recovery being 91.33% of the total value. The combined recoveries were greater by 3.35% than those of previous years. The average direct milling cost was $3.57 per ton, and the average indirect milling cost was $0.228 per ton. The direct cost of production per unit ounce of doré bullion was $0.156. The increased recoveries and decreased costs were due almost entirely to the installation of the continuous-decantation system, during the previous year in place of the old filter method of operation. The cost of remodeling the mill for the new process, amounting to $24,930, of which a balance of $19,662 was due at the beginning of the year, has been since completely refunded.

DETAILED MILLING COSTS AT TONOPAH MILL

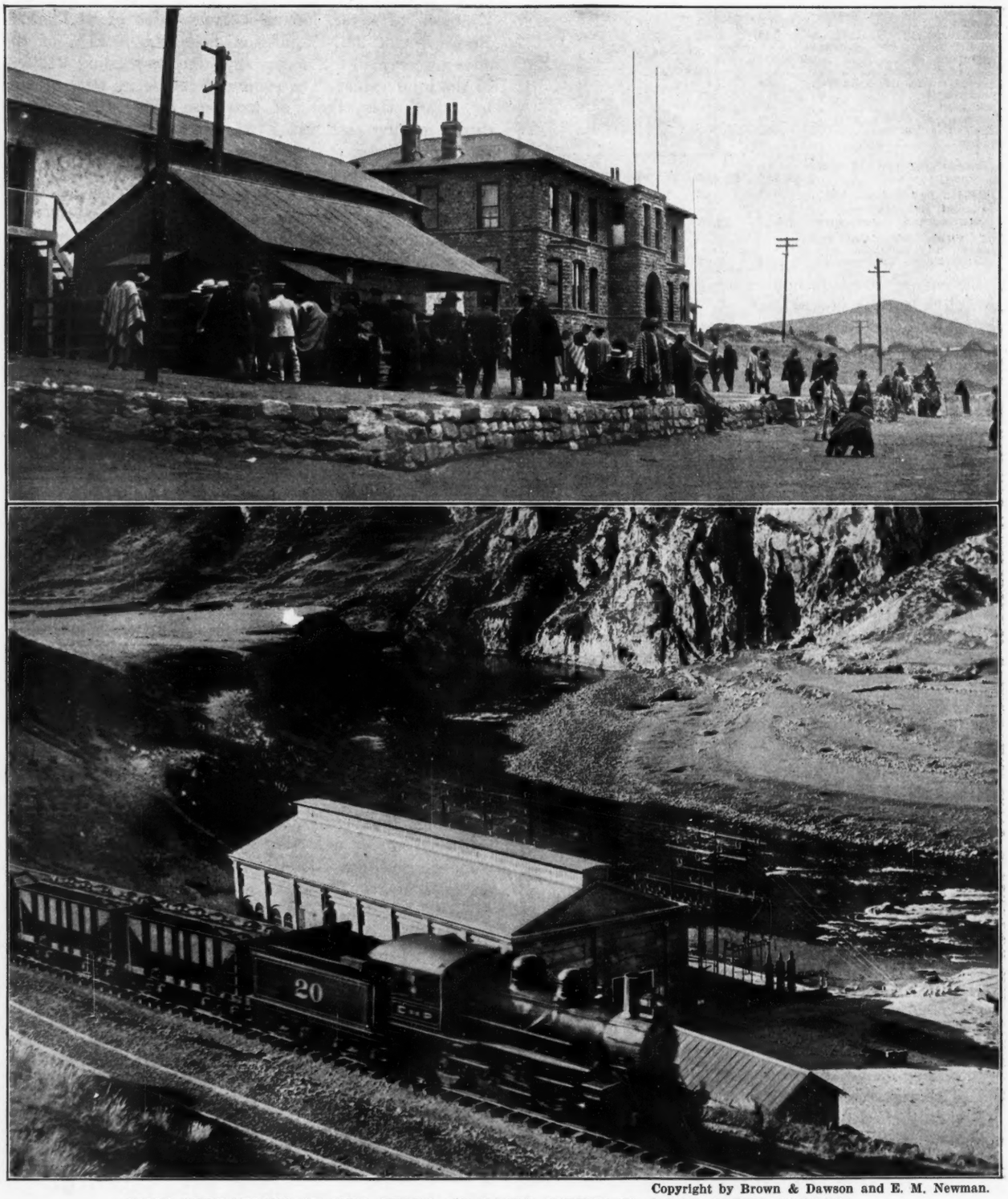
	Cost per Ton
Crushing and conveying	$0.071
Stamping	.331
Classifying	.027
Tube milling	.398
Thickening	.056
Concentrating	.075
Agitating slimes	.864
Filtering and discharging slimes	.187
Precipitating	.225
Assaying	.016
Refining	.041
Lighting	.011
Shaft bosses	.039
Watchmen	.009
Surface and plant	.016
Total direct cost	$2.366
Administration	$0.062
Office and storehouse	.016
Taxes and insurance	.070
Depreciation	.151
General expense	.017
Total indirect cost	$0.316
Total milling cost	$2.682
Combined Milling Costs	
Labor, per dry ton	$0.428
Misc. and sup., per dry ton	1.792
Power, per dry ton	.462
Total milling cost	$2.682

During the year 1,018 tons of sweepings has been recovered under a leasing system from the impounded Tonopah tailings. This contained an average of 0.343 oz. gold and 55.92 oz. of silver per ton, a total gross value of $34,328. The net return from the sweepings was $4,836. A small mill to treat this material will be installed, to cost less than $10,000, and the capital expenditure should be returned, together with some profit, by the end of the first season of operation.

A fire, in December, 1915, caused by the breaking of an oil-feed pipe to the bullion furnaces, almost destroyed the refinery at the Tonopah plant, but with small loss. No product was lost, since a cleanup had just been made.

McIntyre Porcupine Mines, Ltd., in its report for the year ended Mar. 31, 1916, shows a total of 105,758 tons milled at a total cost of $102,389, or $0.9681 per ton. The mill ran 94.4% of the possible time and made a recovery of 95.6%. Labor cost was $0.2531 per ton; supplies, $0.5263; power, $0.1392, and shops, $0.0495 per ton. The new unit of the mill was completed in March, 1916, at a cost of $48,063.

Photographs from the Field



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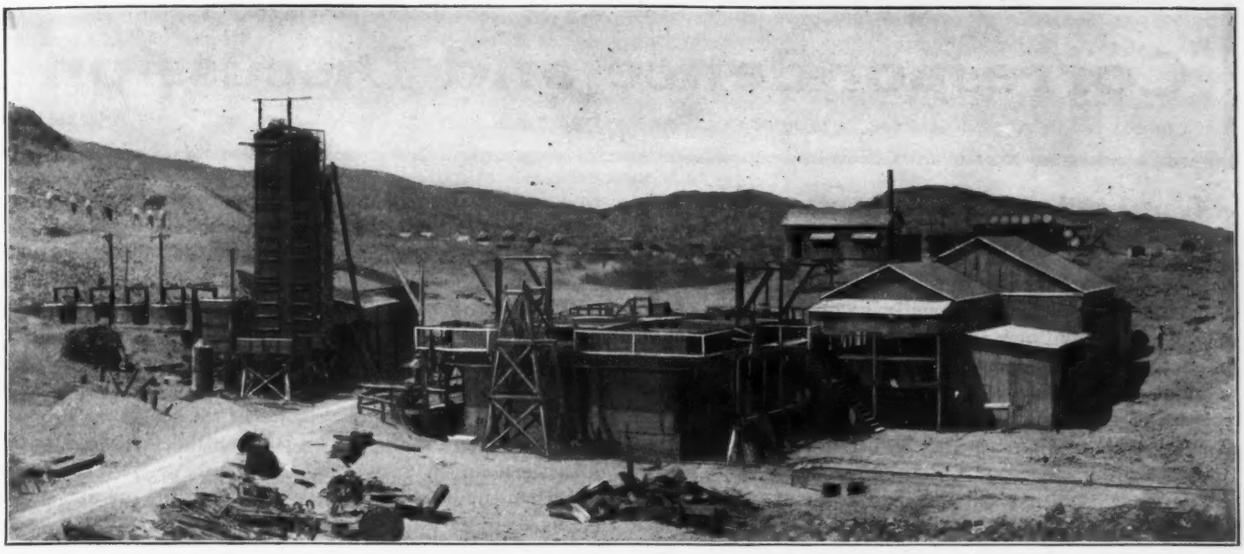
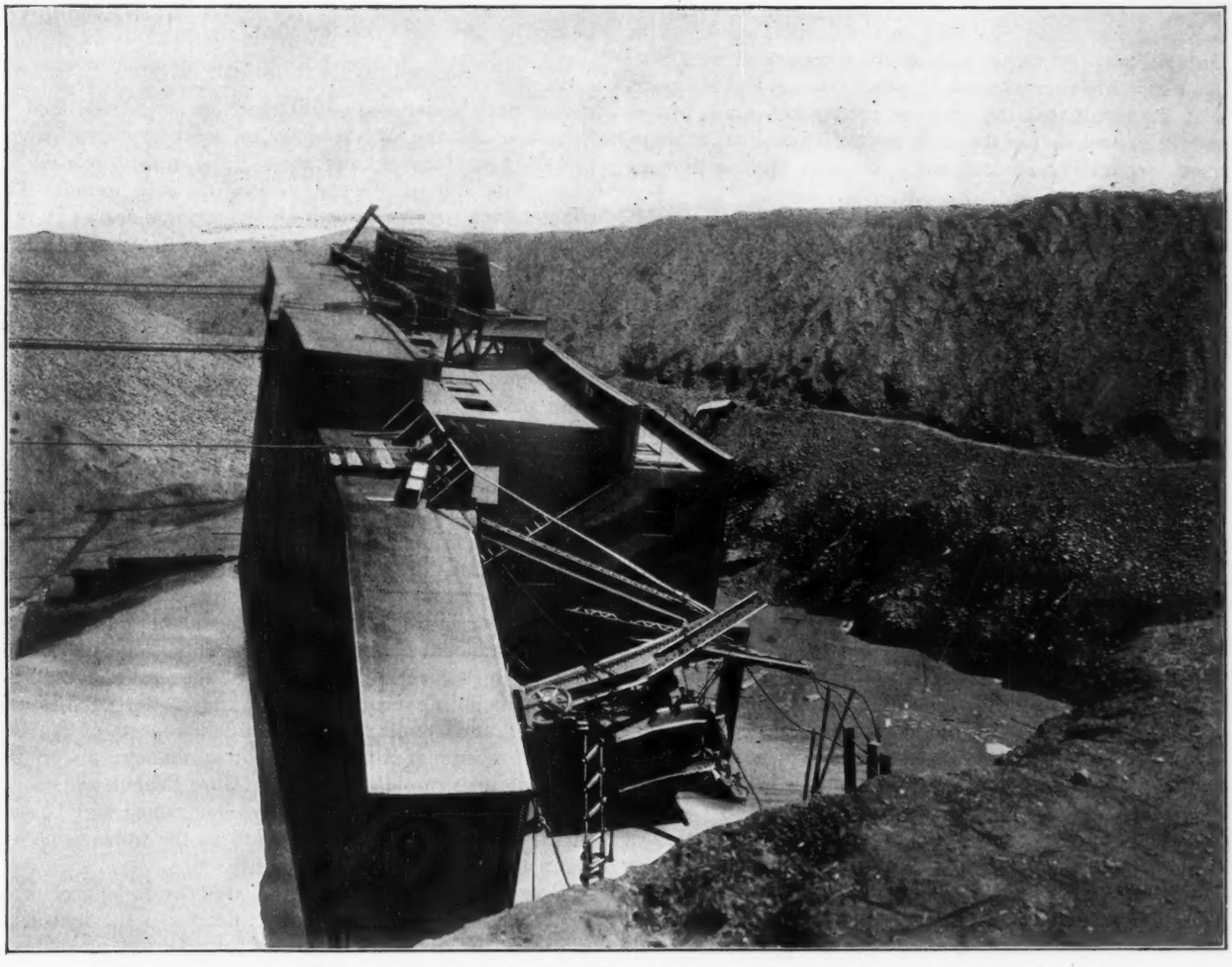
SOME OPERATIONS OF THE CERRO DE PASCO COPPER CO., PERU, SOUTH AMERICA

The upper photograph shows the general office and hotel of the company. The lower shows the power station of the company, near Oroyo, Peru, on the line of the company's railroad



EXPERIMENTAL PLANT OF THE NEW CORNELIA COPPER CO. IN THE AJO DISTRICT OF ARIZONA

The company, a subsidiary of Calumet & Arizona, is building a new town, called Cornelia, modeled on the plan of Washington, D. C. It has avenues radiating from a civic center, where the railroad station and business buildings will be located, together with the company's offices. A separate townsite is designed for Mexican employees



OVERTURNED NATOMAS NO. 7 DREDGE IN THE AMERICAN RIVER FIELD, NEAR FOLSOM, CALIF.

This remodeled steel dredge was put into operation about three years ago and has worked steadily up to the time of the accident

Correspondence and Discussion

Geological Relations of the Sudbury Nickel Ores

As a recent writer in the *Journal* has expressed very decided objections to the usually accepted theory of the origin of the Sudbury nickel-copper ores it may not be amiss to review the reasons which support the theory of magmatic segregation as applied to them.

Most of the important ore deposits of the region were discovered about 30 years ago, before much was known of its geology, but the keen-sighted prospectors were struck by the fact that all the deposits were associated with "diorite." The study of fresh specimens of the rock with the microscope proved that the so-called diorite is really norite; and Barlow and other geologists interpreted the sulphide deposits as magmatic segregations from the norite. Not long afterward it was proved by T. L. Walker that the norite with which the ore is associated passes upward into micropegmatite in certain characteristic localities.

The writer, then geologist to the Bureau of Mines of Ontario, was instructed to map the region, and with various assistants carried on field work there for three years, with the result that the norite-micropegmatite was proved to form a boat-shaped laccolith having a synclinal arrangement, separating ancient rocks beneath from sediments above, perhaps of Animikie age.

It was found also that there are several interesting relations between the eruptive sheet and the orebodies. They are all either at the lower and outer edge of the norite or strung out along irregular dike-like projections from it. For convenience the orebodies at the edge of the norite were called "marginal deposits" and the others "offset deposits." The final results of the field work confirmed the conclusions of the prospectors.

Veins in Country Rock

If one crosses the eruptive sheet from the inner to the outer edge at a marginal mine, such as the Creighton, the micropegmatite gradually merges into norite, which is found after a time to be spotted with blebs of ore. As the mine is approached these blebs become more numerous until half of the rock or more consists of sulphides. The margin between the pyrrhotite-norite and the ore is usually far from sharp and some of it is often included with the ore in mining. The ore itself contains more or less of the minerals of the norite and also often fragments of the country rock and sometimes of norite. These fragments may be angular or well rounded, like boulders or pebbles.

The ore often penetrates in veinlike ways for a short distance into the country rock and is sometimes more or less disseminated in it, though never for any great distance from the norite and never in well defined blebs completely surrounded by unchanged rock, as in the pyrrhotite-norite mentioned before.

A study of thin sections of pyrrhotite-norite from some of the marginal mines shows that the ore blebs are often contained in fresh rock in which even the hypersthene is unchanged. There is no hint of a channel through which the sulphides could have arrived at their present position. The foot wall of marginal deposits may be of any kind without affecting the character of the ore, and at one point or another all of the older rocks of the region are found in this position. The orebodies occur at outward bends of the norite and no ore nor even pyrrhotite-norite occurs at pronounced inward bends of the margin.

Where a bay of the sort just mentioned had no outlet into the country rock a marginal ore deposit is found; but when there was faulting or fissuring the ore and norite made their way outward, often in very irregular ways, and the orebodies may be strung out for three or four miles from the edge of the norite, forming what have been called offset deposits. Sometimes a continuous dike-like band of norite ties an offset deposit to the edge of the main sheet of norite, as at No. 2 mine, Copper Cliff, but in many cases no certain connection can be traced, though norite or pyrrhotite-norite is present at all offset mines, no matter how far from the edge.

Orebodies in Thickest Sheet

The norite-micropegmatite sheet varies a good deal in thickness, and the largest orebodies occur in general where the sheet is thickest; and where it is unusually thin, as in the township of Morgan, no ore has been found. The character of the ore in unfaulted marginal mines is very uniform, often consisting to the eye of pyrrhotite and a smaller amount of chalcopyrite only, though in some mines pentlandite may be found also. It has been shown by Campbell and Knight that pentlandite occurs in all the ores, and their excellent work makes it probable that this is the only important nickel-bearing mineral in the region.

In unfaulted marginal mines there is usually twice as much nickel present as copper, though near the country rock the amount of chalcopyrite always increases, and in offset mines, where rock is usually present in larger amounts, copper commonly surpasses nickel in quantity.

In all the mines there are evidences of slight migration of the minerals, especially chalcopyrite, since the deposits were formed, and in some of the narrower offsets changes due to water action seem to be of considerable importance.

The statement of facts just given represents the results of field work covering the whole of the basic edge of the norite, including visits to every known ore deposit and prospect, and details may be found in reports of the Bureau of Mines of Ontario and in a monograph on the nickel industry published by the Mines Branch at Ottawa. Examples illustrating the features mentioned may be seen in the Royal Ontario Museum and in the working collections of the University of Toronto.

How are the relations mentioned above to be accounted for? My assistants and I often discussed the matter as the work progressed, and it was forced upon us that the norite was the source of the ore. It is evident that the lightest part of the eruptive sheet, the micropegmatite, is on top, merging downward into the somewhat heavier

norite. This becomes charged with blebs of ore at its lowest points and passes into pyrrhotite-norite, which is followed by the heaviest material of all, the ore, settling into all the hollows of the floor. Where there were outlets the heaviest and most fluid parts of the magma penetrated the country rocks forming the offset deposits.

The conclusion is irresistable that the sulphides were once part of the molten magma and that there was a slow segregation in the eruptive sheet, which averages a mile and a quarter in thickness, the materials arranging themselves according to their specific gravities. The separation was, however, not complete, since pyrrhotite-norite, often in immense amounts, overlies all the marginal orebodies. This rock contains innumerable shots of ore, caught when cooling advanced too far to let them settle to the bottom, just as shots of matte may be caught in slag in blast-furnace practice.

The field relations noted above are easily demonstrated and have been seen by many geologists, including a large part of the members of the Geological Congress, who were satisfied as to the correctness of the magmatic segregation theory in accounting for the facts. It would almost seem, however, that Knight has confined his fieldwork to regions outside the norite-micropegmatite sheet, since in his discussion of the relations he does not even refer to these perfectly evident features. Just how he reaches his sweeping conclusion that the magmatic theory is untenable is not evident, since none of his arguments seem to have any bearing on the subject. The statement that there are later granites near or even cutting some of the orebodies is correct, but the segregation process was complete before these granites were erupted, so that they evidently were not the bearers of the ore. The statement that the coarse granite beneath the Creighton orebody is later than the ore does not agree with my own observations nor with the more recent studies of Howe, but even if it were younger no reason can be assigned why granite should not come beneath an already existing orebody.

His second argument, that the Worthington orebody is simply a basic dike, agrees well with the magmatic segregation theory, since this long dike-like offset is traceable from the norite edge near Victoria Mines, and pyrrhotite-norite, a basic rock, occurs at every mine and prospect along it. The norite and ore were squeezed into all the interstices of this long brecciated zone and form the matrix of a sort of breccia to be found here and there for miles. The argument drawn from the Frood, or No. 3 mine, is equally beside the point. The ore and norite have penetrated most intricately all the fissures of the country rock and ore naturally occurs in crushed and brecciated zones of graywacke, as well as other rocks. It may be added that most of the many thousands of tons of ore mined at the Frood were literally pyrrhotite-norite. The members of the Geological Congress took typical specimens of this rock from the ore cars. The statement made that granite and greenstone are spotted with ore in the same way as the pyrrhotite-norite does not at all accord with my observations. The pyrrhotite-norite is often perfectly fresh rock with the blebs of ore clean cut and completely inclosed in unchanged rock minerals, while the granites and greenstones which are spotted with ore have been greatly weathered and attacked. It is quickly seen, also, that the sulphides in the latter rocks are mainly chalcopyrite, while the pyrrhotite-norite contains mainly pyrrhotite. In any case the amount of pyrrhotite-norite is enormous, while the country rocks are seamed and spotted with ore only on a small scale and close to orebodies. That secondary changes have taken place in and near orebodies has never been disputed, and this fact does not conflict with the magmatic segregation theory, which accounts for the origin of the ores and not for their later migrations or changes.

Knight's citation of opponents of the magmatic segregation theory is rather unfortunate. C. W. Dickson, one of the earliest opponents of the theory, called on me some years ago, spent several hours with the microscope over my thin sections of pyrrhotite-norite from Creighton and elsewhere, and could not deny that they favored the magmatic theory. Beck, who at first opposed the theory, is a firm convert to it, as may be seen from the last edition of his Erzlagerstätten. He went over the ground with T. L. Walker during the Geological Congress and made no objection to the usual interpretation. In a letter sent me after returning to Freiberg he expresses his pleasure in the excellent demonstration given at Sudbury. If Knight had read to the end of E. Howe's paper on the Sudbury Nickel Deposits in the June number of *Economic Geology* he would have found that the Creighton orebody is accounted for by magmatic segregation, though the theory receives a somewhat different form from the usual one.

As the presence of later granites in or near certain ore deposits of the Sudbury region seems to Knight convincing proof that they are not of magmatic origin one naturally asks how he accounts for the Sultana, Levack, Whistle, Garson and other marginal mines which are miles away from any late granite and rest upon greenstone, anorthosite or Laurentian gneiss and yet have the same character as orebodies close to the suspicious granites.

Knight has done such admirable work at Cobalt and elsewhere that I feel sure a few days' examination of the field relations of the norite and ore under the guidance of T. L. Walker or the present writer would convince him that the magmatic segregation theory is not the untenable affair that he imagines. It would be a pleasure to Walker and myself if other geologists interested in the problem would join us in such an excursion.

A. P. Coleman,
University of Toronto.

Toronto, Can., June 14, 1916.

Stand for Machine-Drill Repairing

In the *Journal* of May 20 was a description of a home-made stand on which machine drills could be bolted while making repairs to render them much more accessible than when laid on a bench.

While it might cost a little more, it would certainly be much more advantageous to purchase a tripod for this purpose, instead of using this home-made stand. The latter would not be stiff enough to test the drill after the repairs had been made, whereas with a tripod with weighted legs, a big block of wood can be set in or on the ground and the drill can be run, allowing the chuck to strike on the block, and the efficacy of the repairs made can thus be determined before the drill is shipped underground.

New York, June 6, 1916. M. R. Percy.

Compulsory Adoption of Metric System

In these days when Mr. McAdoo is being asked by the Bureau of Standards to push along the compulsory adoption of the metric system into this country by advocating it at the conference in Argentina, it is interesting to have a little side light on Argentine conditions as regards the use of the metric system.

The following excerpt from the May number of *The Americas,* published by the National City Bank of New York and appearing in the June 29, 1916, issue of the *American Machinist,* is from an article on "How to Translate Argentine Prices," by E. F. DuBrul. It will be noticed that while the metric system is by law made compulsory in Argentina, they still continue, according to this article, to measure great estates in square leagues and the square league varies in different provinces. The metric unit has not supplanted this older one.

Also, according to this article, occasionally old Argentine measurements and weights come up and puzzle the country, and the list shows that there are a good many of them. Evidently there would be as little success in this country in abolishing our own present measurements as there would be in any other country, and this article merely confirms the mass of other evidence offered by Mr. Halsey and Mr. Dale to the effect that a compulsory metric system merely adds another system and does not replace the old units. The extract referred to is given herewith:

Great estates in Argentina are often measured in square leagues. The square league is measured differently in different parts of the country, being equal to 10.4255 sq.mi. (6,671.66 acres) in Buenos Aires, Santa Fé and Entre Rios provinces and to 9.6529 sq.mi. (6,177.85 acres) in the National Territories, with varying sizes in other provinces. In San Luis, Mendoza, San Juan and Catamarca the square league equals 2,615.627 hectares; in Cordoba, 2,709.827; in Corrientes, 2,701.088; in Tucuman, 2,662.560; in Santiago del Estero, 1,880.485.

These are the metric measurements. Occasionally the persistent "old Argentine" measurements come up and puzzle the reader. A few of them are:

Onza = 1.012803 oz. = 28.7125 grams
Libra = 1.012803 lb. = 0.4594 kilos
Arroba = 25.32 lb. = 11.485 kilos
*Quintal = 101.28 lb. = 45.94 kilos
Tonelada = 0.904288 English tons = 0.9818 metric tons
Pulgada = 0.947 in. = 2.4055 cm.
Pie = 0.947 ft. = 0.2886 m.
Vara = 0.947 yd. =0.866 m.
Cuadra = 4.17 acres = 1.6871 hectares
†Cuartilla = 7.549188 gal. = 34.2992 liters
†Fanega = 3.774594 bushels = 1.3719 hectoliters
Cuarta = 1.0455 pt. = 0.5937 liters
Frasco = 2.091 qt. = 2.375 liters
Galon = 3.345 qt. = 3.800 liters
Barril = 16.728 gal. = 7.6 decaliters
Pipa = 100.37 gal. = 4.56 hectoliters
Pesada of dry hides = 35.448 lb. = 16.079 kilos
Pesada of salted hides = 60.768 lb. = 27.564 kilos
Pesada of washed sheepskins = 30.384 lb. = 13.782 kilos

*The international quintal is a metric measurement equaling 100 kilos.

†These have also other values as variously stated.

Chemical Exposition To Be Held in New York

The second national exposition of chemical industries will be held at the Grand Central Palace, during the week of Sept. 25, 1916. The list of exhibitors contains the names of the most important and progressive companies engaged in industries in which chemistry plays a part. From this list it appears that the exposition will be twice the size of its predecessor. The American Chemical Society will hold its annual meeting during the whole week. The American Electrochemical Society has arranged to hold its meetings the latter part of the week, Sept. 28, 29 and 30 being the dates chosen, and at least one of these days will be devoted to papers relative to the chemical industry. Many other societies are arranging to hold meetings at the same time.

The Bureau of Commercial Economics at Washington is coöperating with the exposition by arranging an elaborate program of motion pictures covering subjects dealing with the industries depending on chemistry. Many of these films will be shown for the first time at the exposition. Among others, films on the following subjects will be shown: The manufacture of explosives, silver mining, mining and manufacturing of iron, and the manufacture of steel.

Indications are that this will be a greater success than the exposition held last year.

Anaconda's First-Aid Work

BUTTE CORRESPONDENCE

The Bureau of Safety of the Anaconda Copper Mining Co. has made first aid an important part of its activities. This work was begun by the Bureau of Mines rescue car coming to Butte and training a small number of men in the principals of first aid to the injured. From the work done by these few men it was soon noted that there was less infection of wounds in cases that received first-aid attention; also, first aid helped considerably in accidents where men were overcome by gas or electric shock. In the early spring of 1915, when the advantages of first aid had become apparent, the Bureau of Safety asked the Bureau of Mines again to send the rescue car to Butte. The car arrived on Feb. 15 and was used until May 10 in giving first aid-training in Butte, Anaconda and Southern Cross.

ORIGINAL MINE TEAM REPRESENTED MONTANA AT THE NATIONAL FIRST-AID MEET

On May 9 a first-aid contest was held at Columbia Gardens, Butte. Much interest was manifested in this work, and more than 2,500 people turned out to witness the contest. The two teams that made the highest score were sent to Billings, Mont., to participate in the Montana state-wide contest on July 23-24, and brought home to Butte and Anaconda the highest honors, having won both first and second prizes respectively. After the Billings contest, the company decided to send a team to San Francisco to take part in the national first-aid contest and field meet. For the purpose of determining which team should represent the company and the State of Montana at this meet, a series of contests was held during August, resulting in the Original Mine team going to San Francisco where it made a very creditable showing in the national contest.

First-aid work was also inaugurated at the Washoe smeltery in April, 1915, and during the visit of the mine-rescue car at Anaconda 51 men received the training, and an elimination contest was held to determine which team should represent the smeltery at the Butte contest on May 9. Immediately following the Butte contest, the rescue car went to the Great Falls smeltery, where 60 men were trained and a contest held on May 15. The car next went to the company's coal mines at Tracy, Mont., where a number of men were trained. On May 29 a contest was held in which teams from the Great

Falls smeltery, the Tracy mine and several other mines of the Sand Coulee district took part.

While the people of Butte and the officials of the Anaconda company are proud of the achievements of the winning teams, they are still more indebted to the first-aid men individually for the good work done in helping injured men before medical aid can reach them. The real value of the first-aid man is, of course, his ability to help in actual cases of accident and injury. The winning of prizes in first-aid contests is a secondary feature; the idea in holding the first-aid contest is to stimulate public interest in this work.

In line with its policy of making working conditions as safe and healthful as possible, the Anaconda company has decided to put this work on a permanent and systematic basis, and for this purpose has employed John L. Boardman, who was formerly in charge of such work for the United States Bureau of Mines, to assume direction both of the first-aid and of the mine-rescue work in Butte. A new mine-rescue station has been built at the Anaconda mine, and another is being erected at the Tramway mine. Plans have been made to train and maintain a mine-rescue crew of five men on each shift at each mine, and in addition to this a large number of men will be trained in first-aid work. It is planned to register the first-aid men and devise a system whereby each man will be given credit and recognition for the actual first-aid work he does. This system will serve a dual purpose—first, that of encouraging men to take first-aid training and thus fit themselves for properly performing first aid, and second, it will give the Bureau of Safety a more accurate method of determining the value of first aid.

Series of First-Aid Contests

As before mentioned, the purpose of holding first-aid contests is to interest the public in the work rather than to promote rivalry between the teams. Accordingly, a series of contests has been planned for the present season. A rule was made that no team entering the series should contain more than two veteran contest men. The advantage of this rule was that each team had to train four new men with which to fill its ranks. The contest was arranged on the same general plan as a baseball series. Twelve teams, representing as many different mines, entered and a schedule of contests was so arranged that each team met each other team once in direct competition. A contest is held each week, in which six teams take part in such a manner that each weekly contest is really six contests between two different teams. For the purpose of illustration, the contest schedule, with percentages made by each team, for Friday evening, May 12, is given:

FIRST CONTEST, MAY 12, 1916

Leonard Team (99.32%) vs. Bell Team (99.11%).
Original Team (98.22%) vs. Mountain View (95.78%).
Moonlight Team (98.72%) vs. Pennsylvania (97.78%).

SECOND CONTEST, MAY 12, 1916

Bell Team (99.39%) vs. Moonlight Team (99.72%).
Pennsylvania (98.39%) vs. Original Team (99.22%).
Mountain View (98.39%) vs. Leonard Team (99.94%).

At the beginning of the series a list of 48 problems was given the teams, and for each contest three problems were selected from the list. After the fifth week of the series a new list of 31 problems was given the teams and three selected for work at each contest as before. By this method the teams will be obliged to practice on 79 problems and each team will work 39 of these in actual contests.

While it is rather difficult to reduce the value of first-aid work to a dollars-and-cents basis, the testimony of the physicians and surgeons in regard to the work proves its good effect, and the interest manifested by the physicians and surgeons of Butte, Anaconda and Great Falls in donating a great deal of their time to judging the contests and giving lectures to the men is greatly appreciated by all connected with this work.

(Later)—Prizes in the first-aid contest between teams of the various Anaconda mines in Butte have been awarded as follows: Moonlight, $200; Leonard, $150; Original, $125; High Ore, $100; Anaconda, $75; Mountain View, $50. The Poulin and Bell teams were tied for seventh prize.

Mining Company's Liability to Licensee

Defendant mining company, owner of mineral lands in Missouri, permitted decedent and his associates to prospect on such lands. Finding an old skid boiler which had been used on the premises for many years by miners and prospectors, decedent obtained permission to use it. Shortly afterward a leak was discovered in the fire-box and defendant's employees gratuitously repaired it. Four weeks later the boiler exploded, killing decedent, who was attending it alone. There was no eye witness to the accident.

Decedent's widow sued defendant to recover damages on the theory that the accident was due to the negligent manner in which defendant's employees made the repairs, and a jury returned a verdict for $6,000 in her favor. The Springfield Court of Appeals has reversed the judgment, however, exonerating defendant from liability on the ground that plaintiff's proof failed to establish her claim of negligence on the part of defendant or its employees; that negligence could not be presumed from the mere occurrence of the accident, since plaintiff had elected to rely upon a claim of specific negligence in the manner in which the repairs were made, and since decedent, and not defendant, controlled boiler at time of the explosion.

Chronology of Mining for June, 1916

June 1—Strike of miners on Mesabi Range began about this date.—Eagle White Lead Co. and Picher Lead Co. consolidated as Eagle-Picher Lead Co.

June 5—American Zinc, Lead and Smelting Co. purchased Granby Mining and Smelting Co.

June 9—First six smelter-fume suits against the Penn Mining Co. in U. S. District Court at San Francisco, decided in favor of defendant; eleven more cases are to be tried in September.

June 18—National Guard of entire United States called out on account of Mexican situation.

June 19—Couldburst in Joplin district flooded a number of mines and curtailed production.

June 20—Many American mine employees left Mexico; Greene-Cananea works closed.

June 23—Cresson mine in Cripple Creek district sold.

June 30—Yukon-Alaska Trust paid initial dividend.—Interstate Commerce Commission ordered an investigation into the Alaskan railroad and steamship situation.

Editorials

The Mexican Situation

The Mexican situation continues in the mess that was to be expected from bungling. We put a large part of our mobile forces into Mexico to chase a single bandit. Having put them there and not having caught the bandit, we cannot find immediately a way of withdrawing them without letting the Mexicans think they drove us out. In the meanwhile the entire National Guard of the states is mobilized to keep Mexican bandits from raiding our border, which the Mexican government is unable to attend to on its own account.

The mushy-minded of our fellow citizens are now beginning to talk of the pitifulness of things in Mexico and how we ought to go to the help of people there with Red Cross expeditions, etc. Well, we ought to go to their help to be sure, but it should be with a strong hand, for that is the only kind the Mexicans mind. It ought to be recognized, which the Washington Government has steadily failed to do, that anarchy and banditry have been the chronic state of things in Mexico ever since that country gained its independence, save for the period when Diaz established order and maintained it.

The restoration of order in Mexico will be effected only by such methods as Diaz used. There is no Mexican in sight who can do it. The United States sooner or later has got to do it. The present imbroglio will be cleared up, but intervention is merely delayed. It will not be long before some other clash will occur, and then perhaps another, but of course the patience of Uncle Sam is not endless.

Sampling of Spelter

An interesting and entirely friendly controversy respecting the proper sampling of spelter recently arose between a well-known seller and an important brass manufacturer. The seller agreed to furnish two carloads of brass special spelter guaranteed to contain not more than 0.6% lead. The cars having arrived at the buyer's works, he drew 10 slabs from each and finding the assays to exceed slightly the stipulated lead content, called for an adjustment. The seller sent out the agent of a prominent firm of public assayers to draw a new sample of 30 slabs per car. The buyers refused in advance to abide by the result of this.

The issue was clear-cut. The seller claimed that he should be required only to deliver a carload of spelter whereof the average should conform to the guarantee, that in determining the average a large sample is more desirable than a small one and that the conditions of producing spelter do not permit the insurance of uniformity in slabs except in the case of high-grade spelter.

The seller, on the other hand, contended that the conditions of brass-making whereby the spelter is introduced into the melting pots in small lots necessitate uniformity, that its method of sampling during many years had been to draw only 10 slabs at random out of a carload and that no other system would be safe for it.

On none of these points have there been any official rulings. The specifications of the American Society for Testing Materials require as to sampling only that at least 10 slabs shall be drawn. In the contract between buyer and seller in this case, and probably in most of such cases, there was no contractual understanding.

In the present instance the assays were made with the following results, those marked B being made by the buyer and those marked S by the public assayer acting in behalf of the seller:

Party	Car	No. Pieces	Lead, %	Iron, %
S	1	30	0.491	0.013
S	1	12	0.644	0.012
B	1	10	0.737	0.013
S	2	30	0.758	0.021
S	2	12	0.616	0.023
B	2	10	0.667	0.021

The interesting thing about these assays was that in the case of Car 1 the 30-slab sample showed lower lead than the 10-slab, while in the case of Car 2 it showed higher. The discrepancy between the 10-slab and the 12-slab samples is also noteworthy. Manifestly there was irregularity in the composition of the slabs.

As to the merits of the case there is a good deal to be said for each side. The brass maker needs uniformity of the product he is buying. On the other hand, the smelter can hardly insure it by his present methods unless he be distilling high-grade ore that is already uniform. In distilling ore containing lead, the proportion thereof that goes over with the zinc is governed primarily by the temperature of the retort, which varies in different parts of the furnace. In drawing the spelter, the kettle into which it is received holds but a relatively small quantity and the respective pourings from the same drawing may easily vary in composition, especially when lines are drawn so narrowly as they are as to lead content.

Apparently there are two things that need to be done: (1) Sellers in offering a guarantee should specify as to whether it pertains to average of a carload or to any 10 slabs selected at random. (2) If buyers must have uniformity, smelters must insure it by pouring and mixing their product in large pots or melting furnaces before casting the slabs to be marketed.

The Situation of the Galvanizers

In previous articles on the zinc industry we have called attention to the paralysis that was produced in the domestic galvanizing industry by the extravagantly high price for spelter. Previous to the war the galvanizers were the largest consumers of spelter. Since the outbreak of the war the brass makers have displaced them from that position. Of course, the galvanizers have had some demand for their products for military purposes and to a certain extent could afford to continue buying spelter regardless of price, just as the brass makers did, but with increasing consideration on the part of the military buyers, less and less galvanized wire was bought for entanglements and more and more black wire has been purchased.

In the meanwhile the use of galvanized goods for domestic, peaceful purposes has been all but prohibited. One of the bad features of this is what we have previously remarked; namely, galvanization is by no means essential for many of the purposes for which supplied, substitutes are readily available and there was the danger that many consumers would be diverted permanently into using something else. In other words, zinc smelters in reaping ephemeral military profits courted the permanent loss of their trade.

A survey of the state of the galvanizing industry in Pittsburgh and the Ohio Valley that was recently made is interesting in this connection. Many concerns that previous to the war manufactured galvanized sheets have gone out of business entirely. Others are operating only a few pots. The present production of galvanized goods is estimated at only 30%—certainly not to exceed 40%—of what it was before the war. It is possible that at the present level of spelter price some concerns might resume production, but they are deterred by the fear of violent changes in the price. Some galvanizers express the opinion that their industry has received such a hard blow that even after spelter has returned to normal levels, a great deal of business will have been lost by the substitution of painted and black sheets, which will hold the field for many years to come. There is no doubt, however, that the difficulty of obtaining steel plays a part in the hesitancy of galvanizers to reënter the field, those who used to make sheets in their own plants now finding it more profitable to use the material in producing ingots and blooms.

The wire business has fallen off, and barbed wire seems to be the only product now inquired for. This wire for the past year, owing to high price of spelter, has been painted. The domestic demand has been very small, and it has been pointed out that farmers have neglected to repair their fencing, etc., on account of the high price of fence material.

While the pipe business in general has not suffered, the demand for galvanized pipe is receding, black being substituted. All the galvanizers have remarked that they are afraid a large part of their business has gone for good and that it will take them years to recover the lost ground. Various attempts have been made to use a terne mixture for pipe covering, but apparently without much success.

Adit-Driving Methods

Two radically different methods of long adit driving, one in British Columbia and one in Alaska, were given in the *Journal* of June 3, one under "Details of Practical Mining" and the other under "Cost of Doing Things." One adit was 6,500 ft. long, with a cross-section 7x9 ft. The other was 3,671 ft. long, with a cross-section 7½x8 ft. in the clear. These two adits were driven by radically different mining methods. The first, driven originally with a 7x9-ft. cross-section, had later to be "straightened and widened to a minimum of 8 ft." In many places the roof was low and this had later to be taken down. Cutting the drainage ditch along the side of the tunnel was postponed until the tunnel was completed.

Widening a tunnel after it has been driven may be a justifiable necessity, but having to straighten it and take down low places in the roof shows either poor mining or that efficient mining was sacrificed for speed. The aligning, straightening and digging ditch in this tunnel required eight months' time and several thousand dollars, which ought to have been eliminated by more careful work in the original driving of the tunnel, unless there was some exigency not mentioned in our source of information. Even a good miner will occasionally have a hole that does not break well and will have left a low spot in the roof or a rib of rock along the side of his drift, which necessitates swinging his machine around at the next set-up and drilling a pop to shoot out the rib. If this happens once, it is apt to be forcibly commented on by the foreman. If it happens often, the machine man gets fired.

In an adit of this size, 7x9 ft., there is ample room for the setting up of the machines to get a satisfactory placing of the holes of the round to break to good advantage, and there would seem to be little excuse, other than the exigency of speed requirement, for driving such a ragged tunnel as to require eight months' labor at a cost of about $5,000 for straightening and trimming up.

As to whether the cutting of the drainage ditch should be done during the driving or left until the driving is completed may depend on local circumstances, but the method pursued in the British Columbia adit of drilling the right-hand lifter low and deep for the purpose of cutting the ditch is the accepted custom in good mining and takes the minimum, if any more, of extra labor and powder.

Good tunnel men of course are scarce, but a tunnel of these proportions costs so much money, the British Columbia 3,671 ft. long having cost $16.66 per ft., which is very low, that it is not to be undertaken lightly or without the most careful planning. Otherwise there will result delay in driving, higher cost per foot and a disagreeable and costly period at the end, slicking up a job that should have been done better in the first place.

The Proposed Tax on Metals

Congress, in projecting a new revenue measure, proposes to put a tax on munitions of war, supposedly on the theory that their manufacture is highly profitable and therefore capable of being taxed roundly. On the same theory any highly profitable branch of manufacture might be singled out for special taxation. In the present case copper is included with munitions of war. It is a munition of war, but to a larger extent it is an article of domestic consumption for peaceful purposes. Boots and blankets are munitions of war in the same sense as copper. If the copper miner is to be taxed, why not the woolen manufacturer?

We need more money for some purposes, especially military preparedness. Let it be raised by taxation as it must be, but let the taxation be equal. Also the new taxation would not have to be so heavy if the public-building, river-and-harbor and other pork barrels could be eliminated.

The fifth annual report of the Hollinger Gold Mines, Ltd., Ontario, for 1915, has on its front cover a short table showing the tons of ore milled, value of minerals recovered and dividends paid, for each of the last five years. This is a good idea, for it gives at first glance information for which ordinarily one has to hunt through a mass of figures.

BY THE WAY

Why Mining Engineers Go Insane—Our good friend E. B. Kirby has received a letter from "somewhere in Missouri" asking, "Can you locate gold and silver coins, or iron kettles about the size of a teakettle, if either is buried in the ground? If so, what is the least you would charge to come here and how soon could you come?

"P.S. I know of several farms around here where money was buried during the Civil War."

We learn something new in finance every day. A recent advertisement states: "It is the intention of the management of the United Mines Co. to list this stock at an early date on the San Francisco Stock Exchange and other mining exchanges throughout the country, and give it a broad, active market, so that the stock can be bought or sold any day through any broker, but it will be listed at a figure much above the price at which this offer is made to you." Evidently the United idea is that one lists stock at any figure and market opinion of other people cuts no figure.

Sum Buddie writes in to say that after reading an article on slimes, his brain was a maelstrom of colloids, ions, osculatory salt twins, etc., etc. Sallying forth with a 200-c.c. tube and a firm expression, he sampled the wash-mill overflow. Then, crystal-gazing into the murky depths with bated breath (the hero, not the mud), he perceived an erratic electroion-molecularcolloid detach itself and perform dizzy spirals up and town the tube . With visions of a Carnegie medal he grasped his trusty lens, called in his colleagues, and was deep in a learned dissertation on the elusive colloid when the colored office imp said, "Boss, dat am a skeeter wiggler."

The following pneumatic incident is told in a recent number of the *Saturday Evening Post*: A country girl from the lower part of South Carolina—they call them Crackers down there—went to Savannah to pay her first visit to a dentist. The dentist found a jaw tooth badly in need of his services. He drilled away the decayed spots, and then, to clear the cavity of small particles, brought into use a small hand bulb. As the first gush through the blowpipe struck her mouth, the patient flinched.

"Can you feel that air?" inquired the dentist.

The young woman gazed up at him, puzzled.

"That air whut?" she inquired simply.

Certain aspects of the operations by bandits in northern Mexico in the past year are rather forcefully illustrated by a statement in the annual report of the Greene-Cananea Copper Co., just issued. During the year, says the president of the principal subsidiary company, there were "forced payments, requisitions of supplies, and actual robbery in excess of $200,000" on the part of the outlaws. Some of the company's employees were attacked or killed. In spite of this, the company believed at the time of writing the report that a firm government has been established in Sonora, and that operations at the plants would be uninterrupted. The plant has since been left to the tender mercies of said government and all American employees withdrawn.

June Mining Dividends

Dividends paid in June, 1916, by 50 United States mining companies making public returns amounted to $27,917,090, as compared with $10,590,656 paid by 38 companies in June, 1915. Industrial and holding companies allied to mining paid $17,487,378, as compared with $7,432,952 in 1915. Canadian and Mexican companies paid $1,264,667 in June, 1916, and $355,268 in June, 1915.

The totals for the first six months of the year 1916 are as follows: Mining companies, $84,654,924, as against $26,001,044 in 1915; metallurgical and holding companies, $54,529,165, as against $34,164,152 in 1915; Canadian and Mexican mines, $11,428,687, as against $4,535,622 in 1915. The accompanying table shows details of the month's payments.

United States Mining Companies	Situation	Per Share	Total
Amer. Zinc, Lead and Smelting, z	.....	$12.50*	$2,414,000
Argonaut Con., g	Calif.	.10	20,000
Barnes-King Dev	Mont.	.075	30,000
Big Four Explor	Utah	.05	20,000
Bunker Hill & Sullivan, l.s	Ida.	.50	163,500
Bunker Hill Con., g	Calif.	.025	5,000
Butte & Superior, z	Mont.	10.75	2,931,500
Caledonia, l.s.c	Ida.	.03	78,150
Calumet & Arizona, c	Ariz.	2.00	1,283,204
Calumet & Hecla, c	Mich.	15.00	1,500,000
Cardiff, l.z	Utah	.25	125,000
Champion, c	Mich.	6.40	640,000
Chino, c	N. M.	2.25	1,957,455
Con. Interstate-Callahan, l.z	Ida.	1.50	697,485
Copper Range, c	Mich.	2.50	985,002
Federal Min. and Sm., pfd	Ida.	1.00	120,000
Gemini, l.g.s	Utah	5.00	25,000
Golden Cycle, g	Colo.	.02	30,000
Grand Gulch, c	Nev.	.03	7,195
Hecla, l.s	Ida.	.15	150,000
Hercules, l.s	Ida.	.30	300,000
Homestake, g	S. D.	.65	163,254
Horn Silver, l.s.z	Utah	.05	20,000
Joplin Ore and Spelter, l.z	.....	.0575	23,000
Jumbo Ex., g	Nev.	.05	77,500
Kenefick Zinc, z	Mo.	.10	20,000
Kennecott, c	Alaska	1.50	4,170,874
Magma, c	Ariz.	.50	120,000
Mammoth, s.g	Utah	.05	20,000
National Zinc and Lead, l.z	Mo.	.05	25,000
Nevada Con., c	Nev.	.75	1,499,593
New Idria, q	Calif.	1.00	100,000
New Jersey Zinc, z	N. J.	5.00	1,750,000
North Star, g	Cal.	.30	75,000
Old Dominion, c	Ariz.	3.00	486,000
Oroville Dredging	.....	.12	82,380
Quincy, c	Mich.	4.00	440,000
Ray Con., c	Ariz.	.50	777,483
Reorg. Booth, g	Nev.	.05	50,000
St. Joseph Lead	Mo.	.25	352,350
Socorro, g	N. M.	.05	18,865
Success, z	Ida.	.03	45,000
Tomboy, g	Colo.	.24	75,330
United Globe, c	Ariz.	18.00	414,000
United Verde, c	Ariz.	1.50	450,000
Utah Con., c	Utah	.75	225,000
Utah Copper, c	Utah	3.00	4,873,470
Yak, s.l	Colo.	.07	70,000
Yellow Aster, g	Calif.	.12	12,000
Yellow Pine, l.z.s	Nev.	.15	150,000
Yukon Gold, g	Alas.	.075	262,500

* Payable in new preferred stock, par value of which is $25.

Iron, Industrial and Holding Companies	Situation	Per Share	Total
American Smelting and Refining, com	.....	$1.50	751,620
American Smelting and Refining, pfd	.....	1.75	875,000
Crucible Steel	U. S.	2.00	488,730
General Development	U. S.	1.50	180,000
Great Northern Ore	U. S.	.50	750,000
International Nickel, com	U. S.	2.00	3,346,768
National Lead, com	U. S.	1.00	206,554
National Lead, pfd	U. S.	1.75	426,433
Old Dominion of Me	.....	3.00	880,059
Phelps, Dodge	U. S.	6.00	2,700,000
St. Mary's Mineral Land	Mich.	2.00	320,000
U. S. Steel, com	U. S.	1.25	6,353,781
Yukon-Alaska Trust	.....	1.00	208,433

Canadian and Mexican Companies	Situation	Per Share	Total
Dome Mines, s	Ont.	$0.50	200,000
Hedley, g	B. C.	.50	60,000
Hollinger, g	Ont.	.20	120,000
Kerr Lake, s	Ont.	.25	150,000
Lucky Tiger, g	Mex.	.08	57,227
Rambler-Cariboo, c	B. C.	.02	35,000
Right of Way, s	Ont.	.05	84,275
Santa Gertrudis, g.s	Mex.	.24	364,500
Seneca Superior	Ont.	.30	143,665
Standard Silver Lead	B. C.	.025	50,000

The payment by the Yukon-Alaska Trust was its initial dividend. The dividend on Hollinger was on the old stock, and is the last that will be paid on it, the Hollinger merger having been completed.

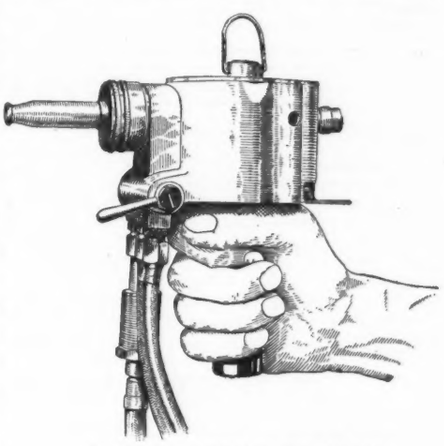
A Metal-Spraying Process

The Schop process for spraying minute plastic particles of metal upon any prepared surface is being exploited by the Metals Coating Co., of America, Boston, Mass., by means of a unique device.

The spray particles enter into the pores of the substance without oxidation and form an impervious coating. Any metal or alloy may be used, and the spray causes no injury to the surface on which it is placed. It has been employed successfully for coating on metal, wood, paper, stone, clay, cement, cotton and silk fabrics, and glass.

It is applied by means of a spraying pistol that weighs only 3½ lb. and operates in the following manner:

Cold wire is pulled from a reel into one side of a cylindrical case, continuously and uniformly, at the rate of about 12 ft. a minute, while at the mouth of the short nozzle at the opposite side there issues a continuous hot blast that carries entrained in it, with a velocity of about 3,000 ft. a second, a very fine spay of molten metal. The mechanism within the case consists of an air-driven feeding and wire-straightening device that leads the metal into the nozzle core. The wire remains cold and unaltered until within $\frac{1}{32}$ in. of the nozzle tip, at which point it undergoes the transformation into spray.



GUN FOR METAL SPRAYING

The nozzle is directed at right angles to the surface to be covered and 5 to 6 in. distant from it. The temperature of the molten metal spray varies according to the melting point of the wire used, yet at the trivial distance of 6 in. none of the materials that have been mentioned are injured or altered in the act of being metallized. Matches held in the zinc spray are immediately coated over without ignition, and the thinnest paper and wood receive the impacting particles into their pores without charring.

British Iron and Steel in 1915

The statistics of the British iron and steel trade for 1915 have been collected for the first time by the new Statistical Bureau of the Iron, Steel and Allied Trades Federation, which took over the work last year for the purpose of securing prompter and more systematic returns than have hitherto been made. New classifications have been introduced, and the figures are presented in satisfactory form.

The production of pig iron, which was given in the *Journal* of May 6 in detail, was 8,793,659 gross tons in 1915, against 9,005,898 tons in 1914, and 10,481,917 tons in 1913, the last normal year.

The quantity sold or exported in semi-finished form in 1915 was as follows in gross tons:

	Bessemer	Open Hearth	Total
Blooms, billets and slabs	324,942	618,603	943,545
Sheet and tinplate bars	163,264	1,356,313	1,519,577
Total	488,206	1,974,916	2,463,122

The total finished rolled and other manufactured steel reported as made in 1915 was 6,325,844 gross tons. The larger items were 1,367,577 tons sheets; 1,160,327 tons plates, over ⅛ in.; 762,717 tons angles and shapes; 534,503 tons merchant steel; 446,502 tons rails. Included in sheets were 603,386 tons tin and terne plates and 353,593 tons galvanized sheets. This report being made under a new classification, comparisons with previous years cannot be made.

The production of steel ingots in 1915 was as follows, in gross tons:

	Acid		Basic		Total	
	Tons	%	Tons	%	Tons	%
Bessemer or converter	821,408	9.8	479,816	5.8	1,301,224	15.6
Open hearth	4,090,752	49.0	2,958,968	35.4	7,049,720	84 4
Total	4,912,160	58.8	3,438,784	41.2	8,350,944	100.0
Total, 1914	4,477,920	57.2	3,357,193	42.8	7,825,113	100.0
Total, 1913	4,860,154	63.4	2,803,722	36.6	7,663,876	100.0

As was to be expected from the nature of the demand, in 1915 the production of steel increased by 515,831 tons over 1914, being the largest make ever reported in Great Britain. At the same time the quantity of wrought iron showed a decrease. The gain was chiefly in openhearth steel

The output of puddled bars for the year is reported at 942,906 gross tons. The production of finished forms of wrought or puddled iron was 1,015,911 tons. The leading items were 549,293 tons bars and rods; 120,777 tons angles and shapes; 135,992 tons hoops and strips; 110,159 tons pipes and tubes.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

CLAD METALS—Process of Making Clad Metals. Byron E. Eldred, New York, N. Y., assignor, by mesne assignments, to General Electric Co. (U. S. No. 1,189,194; July 27, 1916.)

CONCENTRATING TABLE. Howard A. McClelland, Allensworth, Calif., assignor of three-fourths to H. H. Tucker, Los Angeles, Calif. (U. S. No. 1,186,811; June 13, 1916.)

CRUSHER JAW-PLATE. Walter S. McKee, Chicago, Ill., and Frank E. Johnson, Salt Lake City, Utah, assignors to American Manganese Steel Co., Augusta, Me. (U. S. Nos. 187,159 to 1,187,163, inclusive; June 13, 1916.)

CRUSHING—Double-Acting Grinding Pan Mill and Amalgamator. Charles Davey Tregoning, Grass Valley, Calif. (U. S. No. 1,186,709; June 13, 1916.)

DRILL-HOLE SURVEYING—Instrument for Surveying Drill-Holes. Charles Broe Galvin, Cornwall-on-the-Hudson, N. Y. (U. S. No. 1,187,519; June 20, 1916.)

DRILL-SHARPENER, Die, Gager and Former. Charles L. Lawton, Hancock, Mich. (U. S. No. 1,186,806; June 13, 1916.)

ELECTROLYTIC APPARATUS. William E. Greenawalt, Denver, Colo. (U. S. Nos. 1,186,898; June 13, 1916; and 1,187,903; June 20, 1916.)

FLOTATION—Apparatus for Concentrating Ores. Gustaf Emil Ohrn, Lidingö, Stockholm, Sweden, assignor to Minerals Separation Ltd., London, Eng. (U. S. No. 1,187,772; June 20, 1916.)

HOISTING—Controlling Mechanism for Mine Hoisting Engines. Charles E. McDonald, Butte, Mont. (U. S. No. 1,188,292; June 20, 1916.)

LEAD SULPHATE—Method of Manufacturing Lead Sulphate. Bernard S. White, Joplin, Mo., assignor to Picher Lead Co., Joplin, Mo. (U. S. Nos. 1,187,949 and 1,187,950; June 20, 1916.)

MANGANESE—Process for the Recovery of Metals from Ores and the Like. Charles S. Vadner, Butte, Mont. (U. S. No. 1,188,705; June 27, 1916.)

OPEN-HEARTH FURNACE. Bradley P. Wheeler, Duluth, Minn., assignor of one-half to Thomas S. Blair, Jr., Chicago, Ill. (U. S. No. 1,188,867; July 27, 1916.)

TUBE-MILL LINER—Ribbed Tube-Mill Liner. Joseph S. Peterson and Walter Brown Rogers, Smuggler, Colo. (U. S. No. 1,188,203; June 20, 1916.)

PERSONALS

A. F. Bennett from Salmon, Idaho, is in New York.

E. B. Durham is now at Coram, Calif., at the Stowell Mine.

George W. Harris, lately in Mexico, is now at New Orleans.

W. M. Benham, lately at Douglas, Ariz., is now at Cobden, Ill.

Horace H. Crary has gone from Tooele, Utah, to Eugene, Ore.

Douglas Muir, lately at San Antonio, Tex., has gone to California.

E. T. Lednum, recently in Chicago has gone to the Joplin district in Missouri.

W. F. Chase, lately in Chicago, is now with the Commercial Acid Co. in St. Louis.

Lyon Smith is now metallurgist with the Snyder Electric Furnace Co., Chicago.

Hsiang Tsai, recently at Columbia University, New York, is now at Hankow, China.

Edwin E. Chase and son have been in the Butte district in Montana, leaving there this week.

Dr. Milton Hersey, of Montreal, has gone to examine the new mineral regions in Manitoba.

Marion L. Thomas left New York July 5 on a five weeks' trip to examine mines in Venezuela.

Blanchard M. Snyder, late at Los Angeles, Calif., is now at Basin, Mont., with the Cornet mines.

C. E. Minor has gone from Carrizozo, N. M., to Bonanza, Colo., where he is at the Rawley mine.

Heath Steele has returned to New York from a professional engagement in Bonne Terre, Mo.

Alfred James, consulting engineer, has removed his offices to 28 Victoria St., Westminster, London.

Malcolm H. Carpenter lately in Chicago is now with the Shaffer Gold Mines Co. at Seneca, Calif.

Roscoe F. Allen, lately at Billings, Mont., is now with the Winnemucca Mountain Mining Co. in Nevada.

M. B. R. Gordon, formerly of Cobalt, Ont., has gone to Rice Lake, Man., to take charge of three claims the Boulder Mining Co. has taken up.

J. C. Gwillim, professor of mining engineering at Queen's University, Kingston, Ont., has been appointed an officer in the Canadian Engineers.

L. O. Kellogg sailed from New York, July 5, on his way to take up his work as superintendent for the South American Development Co. in Ecuador.

G. A. Scott, of the Coniagas Mines, Cobalt, Ont., is examining properties in the Schist Lake and Flin Flon camps, in The Pas mining region, Manitoba.

Geo. E. Farish, for the past month examining properties along the Mother Lode in Nevada County, California, is expected in New York about July 10.

H. P. Henderson left New York July 5 for the West, to be gone for six weeks. He will visit in turn Springfield, Mo., Jerome, Ariz., and Seward, Alaska.

Richards Harris, of Denver, Colo., who has spent two months in the Rice Lake and Long Lake camps, Manitoba, has returned to Denver to report to his principals.

John Seward has been examining a property in the South, and is now in Ontario investigating several mining properties. He will return to New York about the end of July.

J. E. Spurr, vice-president and consulting engineer of the Tonopah Copper Co. of Nevada, is superintending the proving of a sulphite orebody at Schist Lake, northern Manitoba.

Lieut. Carleton C. Green, mining journalist, of Haileybury, Ont., who was officially reported killed in action, and whose death was briefly noted in this column last week, is alive and has rejoined his regiment.

H. A. Nash, of the Alaska Gastineaux Co., **M. A. Neuman,** Tennessee Copper Co., and **Raymond Brooks,** Arizona Copper Co., recently passed through The Pas on the way to the northern Manitoba mining camps.

Carl J. Trauerman has resigned the position of mill superintendent of the August Mining Co., Landusky, Mont., and in inspecting the properties of the Beaver Creek Mines Co., of Zortman, Mont. After examining mines in the Kendall, Elliston and York districts, of Montana, he will return to his headquarters at Butte.

Bernard MacDonald has moved his office from Los Angeles, Calif., to 715 Mills Bldg., El Paso, Tex., where he will continue his professional work. At present he is collaborating with the engineering staff of the Alvarado Mining and Milling Co. in designs for increasing the capacity of that company's mill at Parral, Chihuahua, from 400 to 600 tons per day. The machinery has been ordered and will be installed as soon as peace is established in Mexico.

Naosaburo Hanabusa, Hogakuhakushi, who has been since 1897 director of the General Statistical Bureau of the Imperial Cabinet of Japan, has resigned that position, and has been named honorary counselor of the bureau. In his administration of nearly 20 years Dr. Hanabusa has brought the bureau to a high degree of efficiency. He is succeeded as director by **Toratoro Ushizuka,** Hogakushi, for some time past secretary of the Imperial Cabinet.

OBITUARY

Joseph K. Dale died at Franklin, Penn., June 26, aged 84 years. Born in Clarion County, Penn., he had been a resident of western Pennsylvania all his life. He was one of the pioneer oil operators in that section and was extensively engaged in the business nearly all his active life.

SOCIETIES

American Society for Testing Materials—The officers elected at the annual meeting at Atlantic City, N. J., last week were: President, A. A. Stevenson, vice-president, Standard Steel Works, Philadelphia; vice-president, S. S. Voorhees, engineer-chemist, bureau of standards, Washington, D. C. Members of the executive committee: W. H. Bassett, American Brass Co., Waterbury, Conn.; John Brunner, Illinois Steel Co., Chicago; G. W. Thompson, National Lead Co., New York, and F. E. Turneaure, University of Wisconsin, Madison, Wis.

INDUSTRIAL NEWS

The Goldschmidt Thermit Co. has removed its general offices to the Equitable Building, 120 Broadway, New York.

The E. H. Moyle Engineering and Equipment Co., of Los Angeles, Calif., has moved into new and larger quarters at 508 East 9th St., Los Angeles.

The T. L. Smith Co. announces that its district manager, E. R. Marker, on July 1, moved to new quarters at 609 Wells St., Milwaukee, Wis., where he will take charge of the business of the company as Wisconsin representative. Mr. Marker will carry a stock of mixers on the floor and will also stock a complete line of contractors' supplies.

George T. Snyder, formerly chief engineer at the National works of the National Tube Co., McKeesport, Penn., has been transferred to a similar position at the Lorain works of the company at Lorain, Ohio. **A. L. Hoerr** has been appointed chief engineer at the National works to succeed Mr. Snyder. **F. W. Waterman,** formerly chief engineer at the Lorain works, has been appointed manager of the new tube mills now being built by the Gary Tube Co., at Gary.

The Jeffrey Manufacturing Co., of Columbus, Ohio, announces the reopening of the Northwestern branch office at Seattle, Wash., and the appointment of Percy E. Wright, consulting mechanical engineer, as district manager for Oregon, Washington, Alaska, British Columbia and Alberta. Mr. Wright, who has been in the Northwest since 1910, and whose connection with this company, dates back to 1902, has had a wide and varied experience and training in the handling of the Jeffrey line in the engineering, construction and sales departments, which will enable him to be of great assistance in solving elevating, conveying and transmission problems.

The Pittsburgh By-Product Coke Co., incorporated under the laws of Delaware with a capital stock of $10,000,000, will own and operate plants for the manufacture of coke and by-products. It will own, among others, all stock of the Seaboard By-Product Coke Co., now building a plant at Jersey City, N. J., and the Minnesota By-Product Coke Co., building a plant at St. Paul. H. B. Rust is president; W. F. Rust and C. J. Ramsburg, vice-presidents; S. T. Brown, treasurer. The directors are A. W. Mellon, R. B. Mellon, H. W. Croft, Hamilton Stewart, H. B. Rust, W. F. Rust and C. J. Ramsburg, all of Pittsburgh.

Editorial Correspondence

SAN FRANCISCO—June 28

An Important Orebody in Cerro Gordo Mine, in Inyo County, was recently opened on the 200 level. This strike is at a point about 500 ft. southeast of the shaft. The ore occurs as a replacement in limestone, is circular in form, 25 ft. in diameter, and where exposed shows an average zinc content of better than 36%. Considerable lead-silver ore also occurs near the zinc. The management considers this orebody the most important disclosed in the mine in recent years. About 40 years ago approximately $500,000 was taken from an orebody directly above the new find through what was known as the Buena Vista tunnel. The square-set system will be employed in extracting the ore and stoping is already in progress. A winze has also been started in the ore on the 200 level. The company is employing 70 men at present and is making regular shipments, the lead-silver ore going to Salt Lake. The ore is carried by bucket tramway 8 mi. to the shipping station at Keeler on Owens Lake, where it is loaded in cars of the narrow-gage railroad built by Ogden Mills several years ago for the handling of the soda products of the Inyo Development Co. In the early life of the Cerro Gordo mine, the silver ores and the lead product of the Cerro Gordo smeltery were transported across the lake by steamboat built for that purpose and hauled 700 mi. by mule teams to Los Angeles; thence transported by steamers to Selby; some of the lead-silver ore was shipped to Wales. This mine has been reopened several times, but until taken over by the Cerro Gordo Mines Co., under the direction of Louis D. Gordon, was not successfully operated.

The Accident-Insurance Rate in the mining classifications was the subject of a recent circular letter by C. W. Fellows, manager of the State Compensation Insurance Fund. Mr. Fellows states that the reduction in the standard rate for gold mines in California from 7.88% in 1914 to 5% in 1915 was entirely due to the efforts of the State Fund; that after the Uniform Rating Law and the amendments to the Workmen's Compensation Insurance and Safety Act. became effective, the Compensation Service Bureau attempted to secure the approval of a substantial increase in the rate over that finally adopted. But the Insurance Fund insisted that the $5 rate, appearing in the basic manual for California gold mines should not be changed but should be extended to cover other metal mines, the latter then being rated at 7.65%. The issuance of this circular letter was brought about by a charge recently made in a paid advertisement that the Insurance Fund was responsible for the increase in rate for gold mines from 5% to 5.75%. The fact is that it actually succeeded in reducing the rate for other (than gold) metal mines from 7.65% to 5.75% and recommended a rate of 5% for all mines; and the management is still urging the adoption of the 5% rate and the merit-rating system, and invites mine owners to coöperate in devising such system as will be acceptable to the State Insurance Commission. Mr. Fellows states that the Insurance Fund has never openly subscribed to the theory that compensation, being a tax upon employers, should be collected without paying a middleman's profit; and that it will not subscribe to such theory until it is demonstrated that insurance companies cannot or will not combine safety to workmen with fair rates for employers. The bitterness with which Mr. Fellows and the Insurance Fund were attacked in the advertisement referred to, appears to have been engendered by statements which were derogatory to some of the competitors of the Insurance Fund. The letter will be welcomed by mining employers who are desirous of knowing the facts and who care nothing about the quarrels that insurance companies may have with the state. The question at issue between the state and the competitors referred to is that of the necessary loading upon pure premium for catastrophe and for expense. Concluding the discussion the letter states that the state ratio of expense to premiums was less than one-half of that of any company; that it is distributing a dividend to California mine owners which averages over 15%, thus reducing the actual cost of 5% to more nearly 4%; that the State Fund is able to save for its policy holders a material part of that loading and in addition its profit on underwriting. The losses have been less than the legal reserve and it has therefore a substantial undivided profit which will be later returned.

Butte—June 28

Agreement in Labor Controversy was reached at an executive session, held June 24, by the arbitration committee, composed of three representatives of the Silver Bow Employers' Association and three representatives of the city's labor organizations. The differences regarding the prevailing wage scale that precipitated the recent strike of the Workingmen's and the Teamsters' Union, were finally settled satisfactorily to both sides. Under the new arrangements workingmen now get $3.75 a day and teamsters $4 a day. When copper drops below 15c., however, wages will drop to $3.50 and $3.75 respectively. The former scale for both organizations was $3.50 a day, so that the new arrangement means an advance all around; overtime will be paid for at 60c. an hour as against 50c. previous to the strike. The settlement is considered by all parties concerned as a step forward in that it established the principle of arbitration and points toward continued peace in the industrial life of the City of Butte.

Northeast Section of Butte District is now coming in for increased attention. The progress made in development work at the Butte & Great Falls and the announcement that the Butte & Bacorn will resume work in July, has brought this section of the district back into the limelight again. Moreover, recent exploration work in the North Butte properties has revealed the existence of valuable orebodies lying undeveloped to the north of present workings. Similar work northward in the Badger, the Black Rock, the Elm Orlu and others has materially added to the ore reserves of these mines and has given to many properties in that section added speculative value. Several new companies are now in progress of formation to develop claims in the northern section of the camp. At the Butte & Great Falls, the farthest north of the developing properties, drifting on the Genevieve has opened promising bodies of copper ore, which upon testing furnished concentrates running 11.5% copper and 4.4 oz. in silver per ton, with a gross value at present prices of over $60 per ton. The crosscut driven to intersect the Big Dewey vein is now estimated to be within 90 ft. of vein. Two other companies are beginning development just east of the Butte & Great Falls properties.

DENVER—June 28

El Paso Consolidated Gold Mining Co., formerly a flourishing concern but of late years leading an uncertain existence (partly through extravagant financing), has been recently emerging from its indebtedness and it is now reported as entirely unencumbered and ready to start a treasury reserve. This company has paid dividends to date amounting to $1,707,545, but the last disbursement was more than two years ago. Fifteen sets of lessees are working and the June production is estimated at about 2,000 tons that will average 1 oz. gold per ton. The company is doing some development in the lower levels.

The Drop in Tungsten Prices is not having much influence on the spirit with which prospecting and development continue in the Boulder field. New mills are being erected. The town of Nederland is planning the liveliest sort of a Fourth of July celebration with all the usual Western sports. About 200 lessees are reported to be working in the Primos properties. A considerable increase in tungsten sales has occurred and miners are adjusting themselves to the idea of producing their ores economically and thus netting good profits even on the reduced margin. The 60% concentrate or ore is now selling at $20 per unit with a 50c. drop for each 1% drop in tungstic-acid content.

SALT LAKE CITY—June 29

Final Figures of Gold and Silver Production of the United States during 1915 show Utah's output in these metals to have been 189,045 oz. gold, valued at $3,907,900; and 13,073,471 oz. of silver valued at $6,522,200.

Production of Utah Copper in June is expected to exceed 17,000,000 lb., the output being well above the previous record of 16,000,000 lb. An average of 34,000 tons daily has been handled; and on June 26, shipments to the Magna and Arthur mills amounted to 41,800 tons, the record output. It is understood that the capacity of the mills will be gradually increased until it reaches 50,000 tons daily. The check for the quarterly dividend of $1.50 a share and the special dividend of $1.50 a

share—amounting to $4,873,470—recently sent out is probably the largest single check ever signed in Utah by the treasurer of a mining company.

The United States Fuel Co. is undertaking development that will double the output of its coal mines in Carbon County. Smelters in Salt Lake Valley and even the Pacific coast afford a market for the product. When wider markets have been established the production will be further increased.

Two Land Auctions—one of 1,600 acres in Wayne County, June 28 and one of 2,800 acres at St. George in Washington County, July 15—have been announced by the state land board. The minimum price has been fixed at $2.50 an acre, with 10% down, and 5% interest. The land is nonirrigated. Notice has been received by I. C. Thoreson, U. S. Surveyor General, as to changes in the Dixie national forest in the southern part of the state, which will throw some land open to settlement in the near future.

Assessed Valuation of Bingham & Garfield Ry. has been in controversy for some time between the company and the tax assessor. The matter has now been settled and the assessed valuation reduced from $5,482,772 to $4,000,000. The reduction was made by the commissioners of Salt Lake County, meeting as a board of equalization through the permission of the state board of equalization. It was contended by the company that the valuation was higher in proportion to the investment than that placed on railroads in the state assessed by the state board of equalization. It was also urged that the earnings of the railroad could not be made the basis of valuation, as these are entirely dependent upon the hauling contract with the Utah Copper.

JOPLIN—July 1

Interstate Mine Operators Association was finally organized this week by operators in the Missouri, Kansas, Oklahoma and Arkansas lead-and-zinc districts. This organization will be given over entirely to the financial interests of the mine operators and there will be distinct limitations in regard to membership. No man having any interest in zinc-smelting companies or who might in any way be allied with smelting interests as opposed to the mining interests, will be eligible. It is expected, however, that the association will have about 300 members.

Employees Called to War will not lose by their patriotism so far as the Kenefick Zinc Corporation is concerned. Arthur Day, vice-president and general manager of the company, came to Joplin this week and announced that any of the company's employees at its five mines in this district, who have been called to join the militia, will have their positions held for them until their return, and if they have dependents will receive $50 a month from the company at least until Jan. 1, 1917, and that further arrangement in this regard will be made at that time.

New Milling Practice for the Joplin district is being initiated by the Eagle-Picher Lead Co., in its third concentrating plant at Picher, Okla. The crusher department, though housed in the same building, is entirely separate from the jig department and between the two is a 300-ton bin for the crushed material. The crusher equipment will have a capacity of 80 tons per hour, but can readily be operated only at one-half that capacity if desired. In the jig department, middlings from the two rougher jigs will go to a chat rougher, thence to the cleaner jig. The sludge department, which is in a separate building, will include 22 tables, an Eccleston ball mill, the first to be brought into this district, to handle the middlings from the tables, and two Dorr thickeners. A surface railway with two 5-ton gasoline engines will be used to bring the ore from three field shafts, which are in addition to the two mill shafts. The plant will have a capacity of 600 tons per 10-hr. shift.

WALLACE, IDAHO—June 26

Bunker Hill & Sullivan Smeltery, near Kellogg, is beginning to assume more definite form. Extensive sidetrack facilities have been put in by the railroad company to expedite handling building material and the Bunker Hill company has also put in trackage leading to the elevated ground to be occupied by the smeltery. Forms for the foundation are now about completed and pouring concrete will begin probably the coming week. A new townsite has been laid out and every lot in the original site has been sold. Additions to the new town, which will be called Smelterville, are being platted.

The Interstate-Callahan now ranks third among the zinc producers of the United States. The manager of that company recently stated that the property would continue to earn good dividends with spelter at 5 or 6c., should this low figure be reached. The present milling capacity is 400 tons per day and there are difficulties which prevent the best results from milling operations. It is understood that these will be overcome before late fall by the construction of a new mill with at least double the capacity of the present one and which will include a large and improved flotation plant. The company has acquired a desirable millsite at Enaville, which will involve a new outlet to the mine on Beaver Creek through a tunnel that will give at least 1,000 ft. depth below the present working tunnel. A shaft is now being sunk from the main level which will connect with the Beaver Creek tunnel. The ore reserves accessible by this new development and a modern mill of large capacity will insure great economy in mining and milling and will enable the Interstate-Callahan to successfully meet any condition of the spelter market. It should be recalled that the Interstate-Callahan produces considerable lead and silver also.

Decline in Price of Spelter may seriously affect the profits of certain Coeur d'Alene companies but it should be remembered that the district as a whole is still a lead-producing camp. With the exception of a few development companies which make irregular shipments, there are only two mines here in which zinc is the major product: Namely, the Interstate-Callahan and the Success. The zinc production of several large lead mines, notably the Morning, Green Hill-Cleveland and Hercules, while a factor of much importance, has not reached a point where the low price of spelter would be an obstacle to profitable operation. That is to say, at these properties zinc is a byproduct with lead and silver as the metals depended upon for profits. Of course these profits have been greatly swelled by the war price of spelter, but these mines were paying good dividends before zinc became a factor and are in position to continue doing so when the price of spelter returns to normal. The most serious result of a permanent decline in the price of spelter would be in discouraging development of new zinc producers.

DULUTH, MINN.—June 30

Crib No. 1 for the new ore dock at Ashland, Wis., is completed and pile driving has been under way for some time. It is estimated that 7,500 piles, 2,000,000 ft. of timber and 750 tons of steel will be required for the two cribs only.

Strike Agitators have been busy in Duluth, endeavoring to get the dock workers to leave their places, to assist the cause of the striking miners, but without avail. The dock workers are receiving higher wages than they ever have in the past and seem perfectly satisfied. The mine strikers are poorly organized and are becoming discouraged. The strike benefits that were promised by the I. W. W. have not been forthcoming. It is not believed the men can be hoodwinked much longer. Many who left work a few weeks ago are returning to the mines, and most of the pits are in operation. All the underground properties, with the exception of a few on the western Mesabi are still idle, but it would not be surprising if some of them would resume next week. Public opinion is now strongly against the I. W. W. because of strikers attacking a man going to work near one of the Oliver properties, taking his dinner pail away from him and giving him a severe beating. Officers, who were close by, rescued the man, but not until a chief of police and one of his assistants had been cut several times with knives. This affair did a great deal to weaken the cause of the strikers. Some of the mining companies have placed boarding cars in their pits, where the men eat and sleep and are not molested. Armed guards patrol the pits and keep all strikers at a safe distance. A few shovels are idle, but shipments are being maintained, the ore coming from the pits and the stockpiles.

TORONTO—June 29

The Rice Lake Mining Area of Manitoba continues to attract numbers of prospectors, but the camp is making slow progress owing to want of transportation facilities. This is shortly to be remedied, as the provincial government will send an engineer to survey a road from the east side of Lake Winnipeg to a central point of the field.

To Facilitate Registering Mining Claims in Northern Manitoba, Hon. W. J. Roche, Canadian Minister of the Interior, is creating a new mining district with headquarters at The Pas. It comprises an area of approximately 200,000 square miles, extending from head of Lake Winnipeg to the Arctic seas, and from Hudson Bay to the Manitoba-Saskatchewan boundary.

Excess Profits Tax is shortly to be a reality for Canadian mines. The Canadian Finance Department is sending out notices to 15,000 corporations and firms liable to taxation on excess profits asking them to fill in forms showing the amount of their bonds, paid-up capital, unimpaired reserve and profits. The assessment will be made before Sept. 1 and payment of the tax must be made before November. c

Serious Labor Troubles Are Anticipated in the Porcupine and Cobalt camps, notwithstanding recent increases in the pay of miners. Labor is scarce on account both of the number of enlistments and increased activity of mining operations and the men are becoming insistent in their demands for increased wages. The prospect of labor disturbances is said to be affecting the market price of some mining issues.

The Mining News

ALASKA

ALASKAN FREIGHT RATES are to be investigated by Interstate Commerce Commission on complaint of J. D. Wickersham and the Sampson Hardware Co. It is charged that the American Smelting and Refining Co. exercises undue control of the copper industry of the territory through ownership of Alaska Steamship and Kennecott Copper companies. The Commission is expected to establish joint rail and water rates to Alaska and within the territory.

ALASKA-MEXICAN (Treadwell)—In May, crushed 16,667 tons, yielding $17,055, or $1.02 per ton; operating expense, $24,346; operating loss, $7,291; construction, $3,541; miscellaneous income, $3,730.

ALASKA TREADWELL (Treadwell)—Crushed in May, both mills, 82,082 tons, yielding $133,953, or $1.65 per ton; operating expense, $96,420; operating profit, $37,532; construction expense, $17,254; net operating profit, $20,277; other income, $11,200.

ALASKA UNITED (Treadwell)—Crushed in May, Ready Bullion mill, 25,298 tons; 700-Ft. Claim mill, 19,040, yielding $56,740 and $25,122, or $2.26 and $1.33 per ton respectively. Operating expense, $31,549 and $39,093. Operating profit, Ready Bullion, $25,191; loss, 700-Ft. Claim, $13,970. Construction, $6,229 and $4,790 respectively.

ARIZONA

Cochise County

McCABE & DOREDOR (Bisbee)—Have installed 60-hp. boiler, compressor and several drills at silver-lead property in Montezuma Cañon.

HELEN'S DOME MINING CO. (Bowie)—Organized to develop Quillin group of 18 gold claims in Apache Pass section. J. H. Jaque, secretary.

BOWIE COPPER CO. (Bowie)—New company to work the Weber-Simmons copper property in Gold Gulch, 14 mi. southwest. P. S. Simmons, manager.

GREAT WESTERN (Courtland)—Leasers have opened good ore; mine recently visited by Courtland Young, president of company, which may operate.

SCHEELITE found in wide quartz vein at entrance of Miller Cañon, by Kelly brothers; James Prescott, representing Eastern investers, has made examination.

NEEDLES MINING AND SMELTING (Courtland)—Sinking Maid of Sunshine shaft of Leadville mine. Shafts 1 and 2 soon to be connected with tunnel; 50 men employed.

Gila County

GREATER MIAMI COPPER (Miami)—McGee & Sikes have been awarded contract for driving 150 ft. of new development tunnel. N. E. Milford, president.

Mohave County

OATMAN UNITED (Oatman)—Installing 40-hp. hoist.

PIONEER (Oatman)—Sacking high-grade ore from narrow stringer.

MIDNIGHT (Chloride)—Shaft down 300 ft. and station being cut. Drifting will be done at this level.

OATMAN CRESCENT (Oatman)—New compressor and drills installed; tunnel being advanced with two shifts.

TELLURIDE (Oatman)—Vein on 475-ft. level crosscut without disclosing commercial ore. Now crosscutting for second vein.

METALLIC ACCIDENT (Chloride)—Crosscut tunnel being driven to cut main vein at about 300-ft. level of this Mineral Park mine.

TOM REED (Oatman)—Starting to sink on Red Cloud claim, which endlines the United Eastern on the northwest. Vein opened at 300-ft. level of Grey Eagle claim.

Yavapai County

G. G. LEMMONS, of London, England, who is endeavoring to establish custom smeltery at Prescott, has optioned Cottonwood group on Groom Creek, Buster property in Bradshaw Mountains, and the Great Belcher on Bug Creek.

NEW STATE (Prescott)—Crosscut on 360-ft. level exposed 5-ft. high-grade gold-silver vein.

BLACK ROCK (Wickenburg)—A 26-ft. vein sulphide ore exposed on 400-ft. level; shaft being sunk to 800-ft. point.

C. D. ROGERS (Wickenburg)—First shipment to El Paso averaged $46 in silver, lead and copper; 16 claims in Pikes Peak district.

COMMERCIAL (Copper Basin)—Operations soon to be resumed; idle several months account Clarkdale smeltery refusing ore; Phelps-Dodge operation.

TIP TOP CONSOLIDATED (Tip Top)—An 8-in. high-grade tungsten vein struck on Tip Top claim; about one ton being broken daily; big shipment to be made in July.

GREEN MONSTER (Jerome)—Electric power will be furnished by Arizona Power Co.; 677-cu.ft. compressor will be installed, and shaft sunk to 1,000-ft. point.

SHEA COPPER (Jerome)—Will sink two-compartment shaft on four claims south of the Copper Chief. Churn drilling also to be begun about July 1. D. J. Shea, president.

UNITED VERDE EXTENSION (Jerome)—One carload daily going to Humboldt and six to Douglas. New 1,300-cu.ft. compressor in operation; 6-in. pipe line being installed in shaft.

BIG STICK (Congress Junction)—Sold to oil operators of Tulsa, Okla. Auto road will be built at once; large tonnage low-grade ore on dump and in mine; 20-stamp mill on property.

POCAHONTAS COPPER QUEEN (Mayer)—Operations being resumed; new shaft being sunk and old shaft being unwatered. Ore will be treated in Gray Eagle mill, 3 mi. from mine.

UNITED VERDE (Clarkdale)—To take care of new men added to mine and smeltery forces, over 70 tents have been erected. Tents supplied with electric lights, water, sanitary and garbage systems.

DUNDEE-ARIZONA COPPER CO. (Jerome)—Sinking shaft, now down 200 ft. on two patented claims, surrounded by United Verde Extension and Jerome Verde. J. H. Hubbard, superintendent; W. E. Defty, consulting engineer.

ZEIGER (Congress Junction)—Charles Zeiger is developing Bishop and Peterson gold groups, 12 mi. east in Weaver mining district. About 2,500 ft. of old workings, including shafts and Bishop and Main tunnels. Completing camp buildings.

LONE PINE VERDE COPPER CO. (Jerome)—New organization, $250,000, to develop 175 acres adjoining Copper Chief, Shea and Jerome-Portland. W. A. Jordan, president; A. C. Labrie, secretary. Several shallow shafts, winzes and 279-ft. tunnel. Tunnel will be driven to tap ore at bottom of winze.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Treated in May, 11,780 tons; yield, including concentrates, £12,139; operating expenses, £6,117; development, £1,426.

OLD EUREKA (Sutter Creek)—Unwatering of this and adjoining Wildman-Mahoney-Lincoln group is progressing. Temporary hoist soon to be replaced with more powerful equipment and steel headframe.

Inyo County

SANTA ROSA (Bishop)—Lessees have opened rich gold ore in a vein, 4 ft. wide. West End Consolidated, of Tonopah, holds control.

Mono County

MASONIC DISTRICT renewing activity. Serita mine producing good tonnage of milling ore; improvements being made in mill; operated by Stall interests. Pittsburgh-Liberty also obtaining good ore.

Plumas County

JAMISON (Johnsville)—Mine now in regular operation, employing 40 to 45 men.

COPPER CLAIMS, north of Chilcoot, in Last Chance district, reported sold by Andrew Murdock; purchasers not announced. Leasers on the Murdock-Canonica recently shipped $4,000 worth of copper ore.

San Bernardino County

TRIAL SHIPMENT of 15 tons of manganese ore recently received at San Diego from Island of San Marcos, on west side of Gulf of California. Los Angeles men reported interested.

RED BIRD (Barstow)—Good ore reported opened for a distance of 200 ft. in this group at Goldstone.

COPPER WORLD (Nipton)—Under lease to Doctor Godsell and associates. Ore being hauled by caterpillar tractors to Cima, on Salt Lake route. Large dumps of this old producer can now be profitably shipped.

PACIFIC MINES CORPORATION (Ludlow)—This company, which took over copper-gold properties of Bagdad-Chase and Roosevelt companies, has begun shipipng ore to United Verde smeltery, at Clarkdale, Ariz. Good ore on bottom level. Frank W. Royer, manager.

Shasta County

MOLYBDENUM is being mined on Boulder Creek, 4 mi. west of Gibson. E. A. Wiltsee, of San Francisco, owner.

MAMMOTH COPPER (Kenneth)—Shipping zinc ore regularly to company's affiliated zinc smelteries in Kansas.

DELTA CONSOLIDATED (Bayles)—Voted recently to erect 50-ton mill and cyanide plant in Dog Creek district.

Sierra County

HERKIMER and BUNKER HILL (Downieville)—Gravel properties bonded to Gustav De Bretteville, of San Francisco.

MORNING GLORY (Alleghany)—Bonded to A. A. Codd, of Reno, Nev. Machinery to be installed and working force increased.

ROCK CREEK (Downieville)—On Alleghany-Downieville serpentine belt. High-grade free-milling ore developed; installing stamp mill. Dolan & Bell own and operate.

ALHAMBRA (Downieville)—A 700-ft. drift in payshoot of good width. Milling to begin on completion of surface improvements. Richardson, Rixey & Sporndli, owners and operators.

Siskiyou County

POLAR BEAR (Gazelle)—Recently shipped car of high-grade copper ore to Mammoth smeltery.

HIGH-GRADE CHROME ORE shipment of 35 tons, made from Gazelle by Frank Chastain and associates.

MINNEHAHA (Yreka)—This San Francisco company hydraulicking on Horse Creek with its new water supply from Collins Creek, 2 mi. distant.

Tuolumne County

PITTSBURGH-SILVER PEAK (Jamestown)—This company, which recently bonded the Bacigalupi gold claims, is sinking 300-ft. shaft.

Trinity County

MANGANESE CO. OF CALIFORNIA (Oakland)—Preparing to ship 50 tons daily of chrome ore from deposit near Wildwood.

COLORADO

Lake County

IMPORTANT DEVELOPMENT in Leadville district is being undertaken by George O. Argall, manager of Iron Silver Mining Co., and several Eastern mining operators, who plan to unwater and develop a rich section of the camp, embracing such properties as the R. A. M., Devlin, Pyrenees, Cyclops, Sawtooth, Keystone and Young America. Development work is to be carried on through the new Mikado shaft, also known as the Gallagher; this is a three-compartment shaft, 1,206 ft. deep, now flooded to the 800-ft. level. About $300,000 will be required for the undertaking, as a complete surface plant is needed, retimbering of shaft throughout, electrical pumping machinery, etc. Equipment ordered and new headframe now being erected at Mikado shaft. Draining this shaft will be large undertaking as extensive stopes exist in many of the old mines in this section. When Mikado shaft is unwatered, it is planned to sink shaft several hundred feet.

VALLEY MINING CO. (Leadville)—Rich silver and manganese ore encountered in workings from tunnel in Prospect Mountain. Tunnel had been driven 1,700 ft. without intercepting any promising orebodies and it was decided to sink an interior shaft on a small fissure cut by the tunnel; at depth of 250 ft., this has developed into an important oreshoot. Attracting much interest as Prospect Mountain is most extensive undeveloped area in Leadville district. Warren F. Page, manager.

Ouray County

MINERAL FARM (Ouray)—This old property, 1 mi. southwest of town, leased by C. R. Wilfley and H. C. Branch. It is understood that ore will be treated by flotation.

Teller County

MODOC (Victor)—At annual meeting in Pueblo decided to resume leasing certain blocks in the mine. Average grade of ore shipped during fiscal year was $34 per ton. Officers elected: A. A. Heiman, president; Anton Frankenberg, vice-president and superintendent; William Young, treasurer; Charles H. Hermsmeyer, secretary.

IDAHO

Bonnerville County

GILBERT & BULLARD (Bingham, Utah)—Have purchased from Idaho Improvement Co. lead-silver property near Antelope, about 32 mi. from Mackay. Will sink shaft.

Lemhi County

GILMORE DISTRICT is becoming more active. New power plant planned by operators interested in the Gilmore Transportation, Tunnel and Tramway Co., which has driven adit intersecting important properties at depth. Producing mines are the Pittsburgh-Idaho, Allie, Gilmore and Latest Out.

Shoshone County

STAR ANTIMONY (Kellogg)—Shipped fourth car of ore. Employing 10 men. G. T. Henwood in charge.

HECLA (Wallace)—Manager J. F. McCarthy states company hopes eventually to increase production 50%. Federal mill recently leased will soon be running one shift, treating 125 to 150 tons.

CONSTITUTION MINING AND MILLING (Kellogg)—Recent development has added materially to ore reserve; drifting on 200-ft. level. Zinc content exceeds lead. Site selected for 100-ton mill. Judge George Turner, of Spokane, president.

RAY-JEFFERSON (Wallace)—New mill will be completed by Aug. 1; original capacity planned, 250 tons per day; after construction started decided to increase to 400 tons. Mill is at junction of Beaver and Carbon Creeks, 10 mi. from railroad; the Oregon-Washington Railroad and Navigation Co. will probably extend its Murray branch up Beaver Creek to the Ray-Jefferson this summer.

MICHIGAN

Copper

AHMEEK (Ahmeek)—Northern end of mine showing better grade ore than was anticipated in early openings. Two stamps in commission.

COPPER RANGE CONSOLIDATED (Painesdale)—Production being handled in Baltic and Champion mills; regrinding plant working satisfactorily. No steps yet taken toward rebuilding Trimountain mill; steel work being cut up and sold at better prices than anticipated, as much of it is available for construction purposes.

Iron

EMPIRE (Palmer)—Shipments started; night shift to be added as soon as additional men can be hired.

BIRD (Crystal Falls)—Negotiations for lease in progress; offered 20c. a ton for ore selling at Cleveland for $3.25 a ton. Ore low-grade.

WAKEFIELD (Wakefield)—Heavy rains washed sand into pit. Shovels at work cleaning up pit. Mine will ship about 1,000,000 tons this season.

SPIES (Iron River)—Drifting stopped; sinking again in progress; down about 450 ft., will go to 650 ft. Decided not to get out any ore this summer.

AURORA (Ironwood)—New shaft started. Expect to complete first of next year. Pabst shaft will be started this month. Delay in receiving materials. The two new shafts will replace three old ones now being used.

MINNESOTA

Mesabi Range

NORTH UNO (Hibbing)—One shovel working in stockpile.

GRANT (Buhl)—Stripping finished for present. One shovel commencing to load ore.

LEONARD (Chisholm)—Hoisting ore through shaft and mining under north bank of pit; 300 men at work.

DEAN-ITASCA (Buhl)—Two shovels are stripping north side of pit. This work will continue throughout the summer.

LAMBERTON (Hibbing)—This mine of the Great Northern Iron Ore properties will begin shipping about July 1. Stripping began last December.

HARRISON (Nashwauk)—Big shovel at work. Shipping. Washing plant working one shift. Butler Bros., contractors, in receipt of three new 70-ton locomotives with 19x24-in. cylinders. Two will be used at Lamberton mine and one at the Harrison.

MISSOURI

Joplin District

MARCUM (Cardin)—Mill completed but bad air holding back operations. Good ore showing.

BINGO (Joplin)—Rebuilding and improving sludge plant totally destroyed by storm two weeks ago.

CULBERT (Joplin)—Moving mill to mine on Banker's land from Shapp land at Tuckahoe. Will mine ore at only 60 ft.

LINCOLN (Prosperity)—Sands from settling tank at Seneca plant will be flumed 325 ft. to settling tank at Mary C mill.

WHAT-CHEER (Duenweg)—Has taken additional 20-acre tract on west. Will reopen old shaft and prospect with drills.

COAHUILA (Duenweg)—Place of C. A. Smith, manager, major in Missouri National Guard, taken by R. C. Bean, until recently manager of company's rubber operations in Mexico.

ADMIRALTY (Cardin)—Second mill started. Two Texas pumps in shaft at third mill unable to lower water rapidly. Unexpected orebody found in shaft at No. 2 mill. Company making three cars concentrates weekly.

BUCHANAN & HOFFMAN (Baxter)—Will erect mill as result of drilling campaign on Toskoff land, just north Kansas-Oklahoma line. Ten holes show rich orebody from 252 to 277 ft. Compressor and pumps already ordered.

MONTANA

Beaverhead County

BOSTON & MONTANA DEVELOPMENT CO. (35 Congress St., Boston, Mass.)—Three shifts working at Spain mine in French Gulch; ore to be hauled by motor truck to Anaconda. At Elkhorn property, shaft will be sunk on Park vein to meet crosscut from tunnel. W. R. Allen, president.

Jefferson County

EAGLES NEST (Alhambra)—A 5,000-ft. tunnel started to cut at depth copper-zinc-silver-gold veins in this group of 32 claims in Warm Springs district.

BOSTON & CORBIN (Corbin)—Mined and milled 3,228 tons of ore in May, with an average recovery of 70 lb. of copper per ton. Directors ordered immediate construction of flotation unit, which is expected to save about $3,000 per month.

Lewis and Clark County

JILSON (Wolf Creek)—Homestake Mining Co. has bonded this group of five claims on Little Sheep Creek, 3 mi. from station, and will sink to water level. New hoist and compressor will be installed.

PEERLESS JENNIE (Rimini)—C. S. Carpenter and D. A. Levy, of Chicago, have leased this old copper-silver-lead producer and will begin operations in July. Mine closed since 1887. Plan to sink new shaft.

Lincoln County

BANNER & BANGLE (Troy)—Improvements costing $500,000 being made by Snowstorm Mines Co. Employing 275 men on railroad to connect with the Great Northern at Troy, hydro-electric power station, and concentrator. Expect to be ready for operation by September.

Silver Bow County

BUTTE & LONDON (Butte)—Two stations on 1,600 level completed and crosscutting will begin with three shifts.

NORTH BUTTE (Butte)—On night of June 24, James Mathews, a motorman. on 3,000 level of company's Speculator mine, was killed; fell from motor and was dragged 35 ft.

BUTTE-COLUMBIA COPPER MINING CO. (Butte)—Butte owners of 35 claims, 5 mi. southeast of Butte, will sink shaft deep enough to establish permanency of copper ore revealed by numerous openings along surface. Tunnel already in 700 ft. will be continued to intercept vein system. Short aërial tramway will be installed to connect mine with N. P. Ry.

DAVIS-DALY (Butte)—Production increased to over 100 tons of ore per day from 1,400, 1,500 and 2,500 levels, that from upper levels averaging 2.5% copper, that from 2,500 level between 5 and 6% copper. On 2,500 level northwest drift from southwest crosscut is in ore for over 400 ft. Manager Creden states that output can be doubled as soon as new hoist is completed in September.

ANACONDA (Butte)—Fire, started by defective electric wiring, destroyed fanhouse at top of downcast air-shaft of company's Tramway mine on night of June 26 and got into first two sets of the shaft timbering. The company's and the Meaderville fire department appeared on scene and soon extinguished the fire. Fearing that fire might mark repetition of the Pennsylvania disaster, all men underground were hoisted to surface in record time and without mishap of any kind. On June 23 Sam Parnell, a miner, was instantly killed on first floor of 2,400 level of company's Belmont mine by a fall of ground.

NEVADA

Esmeralda County

REORGANIZED CRACKER JACK (Goldfield)—Surface equipment completed and shaft repaired to 115-ft. level where south drift is being extended to get under oreshoot indicated in the surface trenches.

HORN SILVER (Hornsilver)—Heavier hoist and compressor being added preparatory to sinking present 540-ft. shaft to 750-ft. level. May consolidate with Silver King. Both properties have shipped.

ATLANTA MINES CO. (Goldfield)—Developments on 1,580-ft. and 1,750-ft. levels said to show considerable low-grade gold-copper ore. On 1,750-ft. level crosscut started west in footwall of main ledge to pick up extension of oreshoot encountered on 1,580-ft. level, Grizzley Bear claim.

Humboldt County

SEVEN TROUGHS COALITION (Seven Troughs)—Bird winze at depth of 1,660 ft. has encountered oreshoot from 1,600 north drift, exposing 18 in. of high-grade ore. Vein apparently straightening.

NEVADA PACKARD (Lovelock)—Mill now running on ore from Knowles-Hampton block. Crosscut from one of three working tunnels disclosed 25 ft. of milling ore, about 185 ft. from surface on dip of 45° vein. J. W. Wilkey appointed superintendent, vice K. Freitag, resigned.

Lander County

COPPER BASIN (Battle Mountain)—Shipments being made to Garfield smeltery by Frank Paul, of Berkeley, Calif., who has six months' option on this Glasgow & Western property.

COPPER CANON (Battle Mountain)—This Glasgow & Western property, 20 mi. from Battle Mountain, leased to L. E. Whicher and associates of New York. Being unwatered. About 200 tons old dump ore being shipped weekly to Garfield, Utah. William Campbell, superintendent.

Lyon County

WEIDLEIN LEACHING PLANT, in leased section of Mason Valley Mines Co.'s idle smelting works at Thompson, has been operating for two months on 10-ton scale and has lately been increased to 20-ton basis. Carbonate copper ores or sweet-roasted sulphides are leached with sulphuric acid—coarse ore in tanks, and fines in six-deck Dorr classifier by counter-current flow of solution. Before precipitation, solution is neutralized with lime and treated with sulphur dioxide until it has dissolved a percentage of gas equal to that of the contained copper in solution. Precipitation of copper ensues when solution is heated to 160° C. under pressure of 100 lb.; in precipitation, sulphuric acid is regenerated in twice the amount originally present in combination with the copper. E. R. Weidlein, manager.

EMPIRE-NEVADA (Yerington)—Shipping several cars of copper ore monthly. J. E. Gelder, manager.

BLUEJAY (Yerington)—E. J. Schrader has leased this copper mine, 4 mi. east of town, and will explore with 200-ft. adit.

YERINGTON CONSOLIDATED (Mason)—Shipping 200 tons copper ore per month to Utah; 15 men employed; L. L. Turner, lessee.

MONTANA-YERINGTON (Yerington)—C. R. Archer and associates working 20 men and shipping about 1,000 tons monthly.

WEST END (Mason)—A. H. Barlow, leasing this property in Mason Pass district, ships about 200 tons of copper ore monthly to Weidlein leaching plant at Thompson.

NEVADA-DOUGLAS (Ludwig)—Employing about 200 men. Shipping 1,200 tons high-grade copper ore per month to Utah smelteries. Remodeled mill and leaching plant recently placed in operation; expected to treat 200 tons daily.

Nye County

TONOPAH ORE PRODUCTION for week ended June 24 was 9,075 tons, valued at $188,610, compared with 8,937 for week previous. Producers were: Tonopah Belmont, 2,978 tons; Tonopah Extension, 2,200; Tonopah Mining, 2,000; Jim Butler, 750; West End, 708; Rescue-Eula, 210; Halifax, 158; North Star, 43; miscellaneous leases, 28 tons.

TONOPAH EXTENSION (Tonopah)—New mill equipment now in operation increased daily capacity by about 50 tons. New cross 5-ft. vein encountered on 1,260-ft. level between Murray and North Merger veins. Repairing Victor shaft.

NEW MEXICO

Dona Ana County

ORGAN DISTRICT is active. Phelps, Dodge & Co. developing the Torpedo and Bennett-Stephenson mines, employing about 100 men. Black Prince mine again worked by owners, shipping high-grade ore to El Paso.

Socorro County

HYDRO-ELECTRIC POWER for Mogollon district may be provided by Earl C. Cleaveland and associates. Measurements on West Fork Creek have demonstrated availability of minimum of 1,000 to 1,500 hp. during dry seasons. The mines lately have used crude oil, freighted about 90 mi. by wagon, as a source of power, at a cost of around $150 per horsepower-year. It is understood operators will contract for power at $100 per horsepower-year.

MOGOLLON MINES CO. (Mogollon)—New three-compartment shaft now 40 ft. below 700-ft. level; being sunk 2 ft. a day; is in commission for regular hoisting above 500-ft. level. Milling about 900 tons weekly. S. J. Kidder, manager.

SOCORRO MINING AND MILLING (Mogollon)—Constructing conveyor to dispose of tailings by elevating and fluming to comparatively flat area in region of mill and avoid discharging into creek, which caused trouble with ranchers in past years. Plant treats 230 tons daily.

OAKS CO. (Almy)—In Eberle mine, encountered pay ore from north drift of raise in south tunnel. Shipping to custom mill. Orebody No. 1 in Clifton mine proved to the north by crosscut in footwall of adit tunnel.

OREGON

Lane County

CHAMPION CONSOLIDATED MINING CO. (Portland)—This company, organized by Olaus Jeldness, of Spokane, and Portland men, to operate the Champion, Helena and Music groups, near Bohemia. Flotation department and 20 stamps are to be added to 30-stamp mill and concentrator. C. V. Bobb, managing director; H. C. Mahon, secretary.

TEXAS

Pecos County

CALUMET & ARIZONA (Warren, Ariz.)—This copper company has been testing Fort Stockton sulphur field. Some petroleum also encountered. Other companies planning to drill.

UTAH

Beaver County

MONTREAL (Milford)—Alfred Frank, of Salt Lake City, has optioned this old Glasgow & Western copper property 5 mi. from Milford.

Juab County

TINTIC SHIPMENTS for week ended June 23 amounted to 187 cars, decline being due to reduction orders from smelters.

RIDGE & VALLEY (Eureka)—New ore opened. Drifting being done from 1,500 level of the Gemini.

UTAH MINERALS CONCENTRATING (Eureka)—Several cars of tungsten ore shipped from Nevada are being treated.

BULLION BECK (Eureka)—Two large new boilers being installed to replace four old ones of smaller type. Development of unprospected section of mine may be undertaken.

EAGLE & BLUE BELL (Eureka)—Ore has been opened on all levels from the 700 to the 1,700 and 100 ft. below it. Shaft to be sunk to the 1,850. During past seven years—in which time mine has been developed from prospect—$446,573 has been paid in dividends. Now earning $360,000 yearly.

Salt Lake County

ALBION (Alta)—Second-class ore from old workings to be treated in jigging plant. Conditions on lower levels improving.

SILVER SHIELD (Bingham)—Development of new strikes has proved disappointing, although there is still some ore showing.

SOUTH HECLA (Alta)—Fifty tons daily being shipped from Wedge workings. So far little development done on new strike made at depth.

BINGHAM MINES (Bingham)—Dalton & Lark mine is producing over 100 tons daily, part of the output being lead-silver and part copper-iron sulphide ore. Conditions at the Yosemite promising.

UTAH CONSOLIDATED (Bingham)—Received an average of 18.61c. per lb. for copper in 1915. Average value of lead ore at smeltery was $12.61 per ton, profit $8.46. At end of year, new lead orebody in Highland Boy limestone west of 13½ fault was being developed. Grade much higher than that shipped during year.

UTAH APEX (Bingham)—Producing about 4,000,000 lb. of lead monthly. May earnings about $150,000 as compared to $152,000, decline being due to drop in the price of lead. Cash on hand, after payment of dividend, will be over $500,000. Sales of shares through London have gradually reduced foreign holdings from 135,000 to 80,000.

WASHINGTON

Ferry County

WALLA WALLA COPPER MINING CO. (Keller)—Compressor and drills being added to expedite development. Electro-chemical treatment plant to be erected when reserves warrant. William E. Malm, consulting engineer; William E. Johnson, mine superintendent.

Stevens County

ELECTRIC POINT (Northport)—Another strike reported in this mine, in drifts south from 210-ft. level; 18 ft. of high-grade lead ore carrying up to 20 oz. Ag. Hauling ore to Boundary, B. C., for shipment to Trail. About 1,000 tons on dump. Roy A. Young, president.

CANADA

British Columbia

NEPTUNE AND UNDERHILL (Sheep Creek)—These silver-lead-zinc claims bonded by W. R. Salisbury, of Salmo.

EMERALD (Sheep Creek)—This group of 20 lead-silver claims on Iron Mountain bonded to H. T. Irvine and associates of Spokane, Wash.

DOLLY VARDEN MINES CO. (Alice Arm)—Work on new 400-ton mill nearing completion; expect to start late in July. R. B. McGinnis, manager.

DEER PARK (Rossland)—In this Consolidated Mining and Smelting Co. property in south belt, 10-ft. orebody high in gold has been opened. Other development with diamond drills is planned.

Ontario

HOLDING (West Shining Tree)—Shaft being put down from which rich samples of gold ore have been taken. D. Rothschild, of Sudbury, holds option.

NEWRAY (Porcupine)—Management has called for bids for 30,000 ft. of diamond drilling. No. 1 vein, which produced $200,000 before it faulted, will be the first sought.

SUDBURY NICKEL REFINERIES, LTD. (53 Queen St., Ottawa)—Has acquired nickel properties in Sudbury district. Plan to treat ore by Burrows' method. A. W. Fraser, secretary.

CROWN RESERVE (Cobalt)—In drifting on vein found on 700-ft. level, another 6-in. vein was encountered running across it. Veins of good milling grade with patches of high grade.

The Market Report

Metal Markets

NEW YORK—July 5

Last week was another one of dullness. The most noteworthy feature was the sharp decline in spelter, the market for which exhibited signs of demoralization.

Copper, Tin, Lead and Zinc

Copper—Our summary for last week might be repeated with accuracy, save that there was a further yielding of prices on the offerings of agencies and trading houses that seem to be becoming more and more anxious to make sales. That tendency reflects the cheaper offerings of producers of crude copper whose output is not under contract.

The new Federal revenue bill as prepared by the Committee on Ways and Means and introduced this week in the House of Representatives, contains the following provisions: " . . . . . Every person smelting copper ore, refining metallic copper, or alloying copper, shall pay for each taxable year an excise tax equivalent to the following percentages of the gross;

"Receipts during such year from the sale or disposition of refined copper or copper alloys and from the sale or disposition of crude or unrefined copper, if sold or disposed of for any purpose except for refining or alloying:

"One per centum of the amount by which such receipts exceed $25,000 and do not exceed $1,000,000.

"Two per centum of the amount by which such receipts exceed $1,000,000 and do not exceed $10,000,000, and

"Three per centum of the amount by which such receipts exceed $10,000,000."

Copper Exports from Atlantic ports in June are estimated at 35,900 gross tons.

Exports from Baltimore for the week included 6,202,272 lb. copper and 933,458 lb. brass to Havre, France.

Copper Sheets are unchanged at 37.5c. for hot rolled and 38.5c. for cold rolled. Copper wire is 31@32c. per lb. for large lots at mill.

Tin—This market continued to sag off in sympathy with the other metals. Transactions were small in volume.

Arrivals of tin at Pacific ports in June are reported at 2,198 tons, indicating a considerable import of Chinese tin.

Lead—A good business was done on Thursday and Friday. The sales included some for export, especially through Pacific Coast ports, which business was taken at 7c., f.o.b. ship. The next three days were observed as holidays by nearly everybody and scarcely any business was done. Late on Wednesday afternoon the A. S. & R. Co. reduced its price to 6.50c., New York, with corresponding cuts in the scale for other places. The news came around through consuming quarters before the official announcement was made. Consequently, lead was available at the reduced price before the trade was generally apprised of the fact.

Spelter—On June 29 a rather large volume of business in spelter for prompt and early delivery was transacted, sales beginning at 10¾c., and running off sharply during the day. Consumers did not figure in this business and throughout the week were conspicuous by their absence. On the part of producers, both large and small, there developed real pressure to sell, and the market became demoralized. The quotations for the week reflect offerings rather than sales, for the reason that the level at which buyers would be interested was not found. Spelter for prompt and early delivery is in ample supply, stocks having accumulated in the hands of producers. Spelter for distant futures has been offered at prices much lower than we quote. Along with the decline in the New York market there was a similar slump in London. At the close the spelter market is in a weak, uncertain and demoralized condition.

Zinc Sheets are unchanged, the base price remaining at $18 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Zinc Exports are reported lighter. Zinc oxide in April was 2,418,821 lb. exported.

Other Metals

NEW YORK—July 5

Aluminum—This metal is quieter and buyers have not been pressing in their demands. At the same time deliveries seem to be more freely made. The current price is 62@64c. for No. 1 ingots, New York.

Antimony—Business was extremely dull, with a weakish tendency. We quote 17@17½c. per lb. for spot. None of the important interests would quote on future shipments from China.

Quicksilver—Market dull. We quote $80 per flask, New York. San Francisco, by telegraph, reports $82.50, market strong. London is unchanged at £16 10s. per flask.

Nickel—The market continues steady with about the same amount of domestic business as usual and with some demand

DAILY PRICES OF METALS IN NEW YORK

June July	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
29	4.7575	65⅛	25½ @25⅝	39⅛	6.80 @7.00	6.62½ @6.75	10.00 @.0.75
30	4.7575	65	25½ @25½	39½	6.80 @7.00	6.62½ @6.75	10.00 @10.50
1	4.7575	65	24½ @25½	39¼	6.80 @7.00	6.62½ @6.75	9.50 @10.00
3	4.7575	65	24½ @25	39¼	6.80 @7.00	6.62½ @6.75	8.75 @ 9.25
4	.....	....	....	....	.....	.....	.....
5	4.7575	63⅞	24¼ @24¼	39	6.50	6.42½	8.50 @ 9.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of silver bars 999 fine.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

June-July	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
29	31 1/16	104	100	132	28.10	173½	174	29½	6.23	63	13.41
30	31	103	100	132	28.10	173¾	174½	28¾	6.13	61	12.99
1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	31	102	98	132	28.10	172½	173	28¼	6.01	51	10 86
4	30⅞	98½	96½	132	28.10	170¼	171	26¾	5.70	48	10.22
5	30½	96½	94½	132	28.10	172¼	172½	28	5.96	46	9.79

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜c.

for export. Quotations are 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel brings 5c. per lb. premium.

Minor Metals—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium,** electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.25 per lb.—**Magnesium** is still high, being quoted at $5.50 per lb. for 99% pure.—**Selenium** is from $3 up to $5 per lb., according to size of order.

The Scotch Shale Oil industry had a fairly prosperous year, notwithstanding competition. All the companies but one were able to pay dividends in the fiscal year 1915-16. Their reports show that about 3,000,000 tons of shale are annually dealt with, yielding nearly 25,000,000 gallons of burning oil, over 5,000,000 gallons of naphtha, 24,000,000 gallons of lubricating and gas-making oils, 30,000 tons of solid paraffin, and 60,000 tons of sulphate of ammonia. The mines and works afford employment to about 10,000 men. The gross receipts were increased by higher prices, especially for byproducts; but the expenses also increased owing to higher prices for supplies and higher wages.

IMPORTS

Imports of the Principal Metals, other than iron and steel, in Great Britain, five months ended May 31, in long tons:

	1915	1916	Changes
Copper	95,187	58,704 D.	36,483
Tin	21,332	15,172 D.	6,160
Lead	112,167	76,378 D.	35,789
Zinc	44,149	16,665 D.	29,484

Gold, Silver and Platinum

NEW YORK—July 5

Gold continues to come in at New York, although the amount reported this week has been less than for several weeks past. The amount has been so large lately that a considerable quantity has been sent to the Philadelphia Mint for storage.

A consular report says that at the close of May the gold holdings of Japan amounted to 540,000,000 yen ($269,190,000), of which 170,000,000 yen ($84,745,000 was held at home, 90,000,000 yen ($44,865,000) in the United States, and 28,000,000 yen ($13,958,000) in Europe.

Platinum continues dull. The jewelry trade is taking none at present, and in other lines buyers are taking only what they are obliged to. Supplies do not improve. April imports were only 2,544 oz. Quotations are $74@77 per oz. for refined platinum. Hard metal is $4@6 per oz. higher, according to quality.

The French Mint during the year 1915 produced for French circulation 13,963,409 silver pieces of 2 fr., 47,955,158 1-fr. pieces, and 20,892,772 50-centime pieces. There were also produced 535,227 nickel 25-centime pieces, 4,362,468 bronze 10-centime pieces, and 6,032,140 bronze 5-centime pieces. No gold coins were produced during the year. The total number of coins emitted for French circulation was 93,741,174 of a face value of 87,200,022 fr. ($16,829,604). In addition to the above there were manufactured for Morocco, Tunis, Ethiopia, and Servia 2,602,580 pieces of 2 dinars, 7,529,016 of 1 dinar, and 7,901,068 of 50 paras.

Silver—The market has been a declining one the past week, owing to lack of demand in London. The more peaceful outlook in Mexico has removed the apprehension of a shutdown in Mexican mining operations in case of a war. The London stock of silver has increased, being now some £1,500,000. Indian banks have sold silver in London, which has caused a drop in price coming on a dull market and London closes quiet at 30½ pence.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—July 1

The base price paid this week for zinc ore was $68@71 per ton 60% zinc for top grades down to $65 base for medium grades assaying down to 50% zinc. The base price paid for 80% lead ore was $80 per ton.

SHIPMENTS, WEEK ENDED JULY 1

	Zinc Ore, Lb.	Lead Ore, Lb	Sulphur Ore, Lb.
Week	5,876,000	187,300	1,852,400
Year	119,716,000	4,335,010	29,999,800

Shipped during week to separating plants, 7,628,000 lb. zinc ore.

JOPLIN, MO.—July 1

Blende, high price, $87.50; per ton 60% zinc, premium ore, $85; medium, $80@70; low, $65; calamine, per ton 40% zinc, $55@45; average, all grades of zinc, $78.81 per ton. Lead ore, high price, $79.30; base, $82.50 per ton 80% metal content; average selling price, all grades of lead $77.98 per ton, a large quantity of the shipment being from previous purchases on $80 base.

SHIPMENTS WEEK ENDED JULY 1

	Blende	Calamine	Lead	Values
Totals this week..	13,267,080	346,340	2,453,180	$631,460
Totals this year...	360,017,010	28,857,170	61,724,520	$22,416,800

Blende value, the week, $527,760; 6 months, $18,614,220.

Calamine value, the week, $8,720; 6 months, $1,033,720.

Lead value, the week, $94,980; 6 months, $2,768,860.

Compared with the first six months of 1915 the zinc shipment is a gain of 37,540 tons; the lead shipment is a gain of 9,390 tons and the gain in value is $10,752,000. The average price of blende six months this year is $103.78 against $70.20; last year; the average of calamine is $71.73 against $41.49; the average of lead is $89.74 against $51.81 per ton. While the prices of blende and calamine rose to a phenomenal level in June, 1915, the early part of the half-year ore sold on a low level. The half-year of 1916, just closed, was opened with the strong price level at the close of 1915 and held at a high average until the second week in May, when the average price fell below $100 per ton, all grades of zinc ore.

OTHER ORES

Manganese Ore imports at Baltimore for the week were 9,000 tons from Brazil. These Brazilian ores imported are mainly under contract and very little comes on the open market.

Antimony Ore—Little or no business is reported and the price is nominally unchanged at $2 per unit.

Tungsten Ore—The position has not changed materially. While many inquiries are coming in, no large sales have been made. For the small business transacted the price remains nominally at $30@35 per unit.

The concentrating mills in the Boulder District in Colorado have reduced their prices to $20 per unit for 50% ore.

Iron Trade Review

NEW YORK—July 5

The month of July is generally counted a dull one in the iron trade, and this year it seems to be no exception to the rule so far as domestic business is concerned.

The export trade is very active, though not quite so heavy as some reports would have us believe. However, the larger mills are generally filled up for the next six months and will have no motive to cut prices. The smaller mills, or at least some of them are not so fortunate and may need work by the end of the quarter, and will then be ready to take work as they can get it.

The trouble with Mexico causes much discussion. The general belief is that the Government will need a lot of material and will insist on precedence for its contracts. This will interfere considerably with the export business.

Exports from Baltimore for the week included 7,830 tons pig iron and 1,007 tons steel billets to Genoa, Italy.

According to the summary prepared by the "Railway Age Gazette," railroad orders placed in the half-year ended June 30 included 3,066,850 tons of rails, 89,293 cars and 1,177 locomotives; these totals being more than three times those for the first half of last year.

PITTSBURGH—July 3

The steel market has now entered upon the July-August period, which is invariably dull; but this year the summer dullness really began about the first of June. There is very little fresh domestic demand coming out for any finished steel products, but specifications on contracts are fully as heavy as expected in the circumstances. Deliveries are reported as better, but are no greater than buyers require and there is no semblance of a surplus of steel in any quarter. Outputs will be cut down by hot weather in the next couple of months.

The large mills are adhering very strictly to base prices and are so well sold up through the year that there is no expectation of their cutting prices even should the market continue relatively dull through the fall. The small mills on the other hand have an average of perhaps no more than about two months of work ahead of them and demand will have to be somewhat better than at present to carry them to the end of the year.

Export demand continues excellent, and while there is still demand for shell steel, despite the heavy buying in May, the demand from neutral countries is quite prominent by comparison. Russia is still to place some rails, as well as cars and locomotives. The car and locomotives orders will likely be placed in Canada, a large portion to be then farmed out in the United States.

Pig Iron—The market continues to suffer sentimentally from the weakness in Southern iron, due to the offering of warrants held speculatively, and there is little inquiry except

for export bessemer, for which good prices are obtained. W. P. Snyder & Co. announce their computations of average prices obtaining on all sales of Valley iron in June in lots of 1,000 tons and upward at $21, Valley, for bessemer, an advance over May of 16.7c., and at $18, Valley, for basic, a decline of 16.07c. Thus it is shown that sellers of basic did not obtain their asking prices of $18.25 to $18.50. The average price of foundry iron in June as shown by market quotations was $18.39, Valley. The market is quotable as follows: Bessemer, $21; basic, $18; foundry and malleable, $18,25@18.50; forge, $18@18.25, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The billet market is even stronger than formerly, reflecting a tightly sold up condition of the mills, as while the demand is fair it is not of really large proportions. The export market is by far the more active, and the demand in that quarter is for ingots as well as billets, probably because they can be rolled to size when delivered, while billet sizes must be specified long in advance. Soft openhearth ingots readily bring $42@43 for export. Bessemer billets and sheet bars are quotable at $42@43 and openhearth at $44@45 f.o.b. maker's mill, Pittsburgh or Youngstown.

FERROALLOYS

Ferromanganese—The market is very dull and not enough inquiry is developed to fix the prompt market closely. It is quotable at about $200@250, with contracts for delivery in 1917 at $175 as formerly.

Further restrictions have been placed on exports of ferromanganese from Great Britain, the object being to prevent exports of steel to any hostile countries.

Imports of ferromanganese at Baltimore for the week were 2,350 tons from Great Britain.

Spiegeleisen, 20% is quoted at $50@55 at furnace; high grade, 30% brings $60@65 per ton at furnace.

Ferrosilicon is nominally unchanged at $83@85 at furnace for 50%; but premiums are still charged for early delivery. Bessemer ferrosilicon is quoted from $33 for 10% up to $43 for 16%, at furnace.

Exports from Baltimore for the week included 79,691 lb. ferrosilicon to Chile.

An electric furnace plant containing three 750-kilowatt furnaces has been established at Keokuk, Ia., by the Keokuk Electro-Metals Co. to produce ferro-alloys using power from the Mississippi River dam at that point. The furnaces are after designs by the company and have been placed in operation, although shipments have not been started. Their annual capacity is 2,500 to 3,000 tons of 50% ferrosilicon per year.

British Exports of spiegeleisen, ferromanganese and ferrosilicon, five months ended May 31, were 28,290 gross tons in 1915, and 56,304 tons in 1916; increase, 28,014 tons.

FOREIGN IRON

Swedish Iron Production for the quarter ended Mar. 31 was 197,600 metric tons pig iron; 29,700 tons wrought iron; 18,600 tons bessemer steel ingots; 135,300 tons openhearth ingots. The rolled iron and steel reported was 104,500 tons. Exports for the quarter were 114,600 tons, the chief items being 49,600 tons pig iron, including ferrosilicon, and 34,600 tons wrought iron bars and wire rods.

Steel Production in Germany in April is reported by the German Iron and Steel Union at 1 203,398 metric tons, being 144,397 tons less than in March. For the four months ended Apr. 30 the make of steel was, in metric tons:

	Basic	Acid	Total
Converter	2,419,760	50,353	2,470,113
Openhearth	2,055,922	107,400	2,163,322
Direct castings	189,969	102,229	292,198
Crucible	.....	34,617	34,617
Electric	.....	56,678	56,678
Total	4,665,651	351,277	5,016,928
Tot.l, 1915	3,806,223	214,365	4,020,588

The production keeps up well to about 60% of that of a normal year.

British Exports of Iron and Steel, five months ended May 31, were 1,201,117 gross tons in 1915, and 1,572,588 tons in 1916; increase 371,471 tons. The larger gains were in pig iron, bars, plates and sheets. Imports for the five months were 452,283 gross tons in 1915, and 392,794 tons in 1916; increase, 32,489 tons. The gains were chiefly in steel ingots, steel bars, iron bars and pipe.

IRON ORE

The movement of iron ore has been very active. The figures of Lake ore shipments for June are not yet at hand, but it is probable that the total surpassed the large shipments of May.

The strike of the miners on the Mesabi range has not yet affected the rate of shipments. Ore is being sent forward from stockpiles, as well as from mines. The attempt of the strikers to get out the dockmen failed and there has been no interruption at the ports. The strike seems to be losing ground at the mines.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 417,540 net tons; shipments, 420,709 tons.

Connellsville—With the large contract business done in recent weeks there is very little uncovered furnace coke consumption for the second half. The contracting was done at rather steadily declining prices, the latest contracts being chiefly at $2.35 for the half year, but sales for July, and July and August, brought $2.50 without difficulty. Spot furnace coke has been in light demand despite the necessary curtailment in production and shipments this week on account of the holiday. We quote: Spot furnace, $2.40@2.50; contract, $2.35@2.50; spot foundry, $3.25@3.50; contract, $3.50, per net ton at ovens.

Exports and Imports of Fuel in the United States four months ended Apr. 30, in long tons:

	Exports		Imports	
	1915	1916	1915	1916
Anthracite	949,261	1,092,075	191	4,445
Bituminous	3,023,255	4,381,898	515,197	610,246
Coke	217,570	365,055	12,269	24,159
Bunker coal	2,265,359	2,248,745	.....	.....
Total	6,455,445	8,087,773	527,657	638,850

The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The chief trade, to the imports and exports, is with Canada. The larger increases in exports this year were to Argentina, Brazil and Italy.

Exports of Fuel in Great Britain five months ended May 31 were, in gross tons:

	1915	1916	Changes
Coal	18,775,284	15,809,763	D. 2,965,521
Coke	366,996	604,673	I. 237,677
Briquettes	509,471	586,296	I. 76,825
Bunker coal	6,334,542	5,467,575	D. 866,967
Total	25,986,293	22,468,307	D. 3,517,986

The bunker coal is fuel furnished to steamships in foreign trade, or sent abroad for the use of such ships.

Chemicals

NEW YORK—July 5

The general market has been quiet over the holiday, and prices have shown some tendency to weaken.

Arsenic—Spot arsenic is rather scarce and prices have held together pretty well. Quotations are $6.25@6.50 per 100 lb. for spot material.

Copper Sulphate—The market is again easier on a moderate demand and prices have weakened again. Sales are reported at $10@11 per 100 lb., and there is talk of further shading.

Nitrate of Soda—Shipments are reported as running heavy, but the demand is good and prices are firm. Current quotations are $3.10 per 100 lb. for spot, and $3.07½ for July.

Exports from Chile five months ended May 31 were, in long tons:

	1914	1915	1916
To United States	276,950	298,650	520 100
To Europe	680,100	303,900	548 500
Total	957,050	602.550	1.068,600

The quantity afloat for Europe on May 31 was 322,300 tons.

Pyrites—Imports at Baltimore for the week included 5,937 tons iron pyrites from Huelva, Spain.

Sulphur—The market is firm and prices continue high, owing chiefly to high freight rates. Current quotations are $30 per ton, New York, for early delivery.

Sulphuric Acid—The market is easier owing to increased production, and sellers are inclined to urge their product on the market. Ordinary 60-deg. acid can be had at $20 per ton at works; while 66-deg. acid is quoted at $35@40 per ton for prompt shipment.

PETROLEUM

The monthly statement of the "Oil City Derrick" shows new oil wells completed in June: Pennsylvania grade, 642; Lima-Indiana, 106; Central Ohio, 30; Kentucky, 52; Illinois, 184; Kansas, 488; Oklahoma-Arkansas, 806; Texas Panhandle, 65; North Louisiana, 42,; Gulf Coast, 130. In all this is 2,545 new wells, with a total production of 190,741 bbl. daily. There were 142 gas wells and 393 dry holes reported. There were 4,492 wells in progress at the close of June.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt.
Acacia, g.	Colo.	1,438,989	$ 1	$ 122,004	Jan '11	$0.01
Adams, s.l.c.	Colo.	80,000	10	778,000	Dec. '09	0.04
Ahmeek, c.	Mich.	200,000	25	4,650,000	Apr. '16	3.00
Alaska Mexican, g.	Alas.	180,000	5	3,507,381	Nov. '15	0.10
Alaska Treadwell, g.	Alas.	200,000	25	15,785,000	May '16	0.50
Alaska United, g.	Alas.	180,200	5	2,045,270	Feb. '16	0.30
Allouez, c.	Mich.	100,000	25	350,000	Apr. '16	1.50
Am. Zinc, Lead & Sm.	U. S.	193,120	25	1,108,820	Apr. '13	0.50
Anaconda, c.	Mont.	2,331,250	50	106,566,875	May '16	1.50
Argonaut, g.	Calif.	200,000	5	1,740,000	June '16	0.10
Arizona Copper, com.	Ariz.	1,519,896	1.20	17,923,484	Mar. '16	0.30
Arizona Copper "A," pf.	Ariz.	160,000	1.20	247,795	Apr. '16	.....
Arizona Copper, pf.	Ariz.	1,266,120	1.20	1,940,880	May '16	.....
Baltic, c.	Mich.	100,000	25	7,950,000	Dec. '13	2.00
Barnes-King, c.	Mont.	400,000	5	60,000	June '16	0.075
Bingham N. H., c.	Utah.	228,689	5	960,493	Dec. '15	0.05
Bonanza Dev., g.	Colo.	300,000	1	1,425,000	Oct. '11	0.20
Brunswick, g.	Calif.	395,287	1	203,315	Sept. '15	0.06
Bunker Hill Con., g.	Calif.	200,000	1	851,000	June '16	0.02½
Bunker Hill & Sul., l.s.	Ida.	327,000	10	17,590,500	June '16	0.50
Butte-Alex Scott, c.	Mont.	79,311	10	1,054,119	Apr. '16	10.50
Butte-Ballaklava, c.	Mont.	250,000	10	125,000	Aug. '10	0.50
Butte & Superior, s.	Mont.	272,697	10	11,383,024	June '16	10.75
Caledonia, l.s.c.	Ida.	2,605,000	1	1,325,581	June '16	0.03
Calumet & Arizona, c.	Ariz.	641,602	10	25,666,253	June '16	2.00
Calumet & Hecla, c.	Mich.	100,000	25	132,250,000	June '16	15.00
Camp Bird, g.s.	Colo.	1,100,051	5	10,806,551	Jan. '16	0.24
Centen'l-Eur., l.s.g.c.	Utah.	100,000	5	4,150,000	Apr. '16	1.00
Center Creek, l.z.	Mo.	100,000	10	580,000	Apr. '16	0.25
Champion, c.	Mich.	100,000	25	14,120,000	June '16	6.40
Chief Consolidated, s.g.l.	Utah.	880,676	1	439,219	May '16	0.05
Chino, c.	New Mex.	869,980	5	9,742,925	June '16	2.25
Cliff, g.	Utah.	300,000	1	90,000	Jan. '13	0.10
Cliff, g.	Alas.	100,000	1	210,000	Oct. '13	0.01
Colo. Gold Dredging	Colo.	100,000	10	775,000	Feb. '16	1.00
Colorado, l.s.g.	Utah.	1,000,000	0.20	2,570,000	Dec. '12	0.03
Commercial Gold	Ore.	1,666,000	1	230,490	May '16	0.00½
Cons. Inter. Callahan l.z.	Ida.	464,990	10	3,952,415	June '16	1.50
Continental, s.l.	Mo.	22,000	25	561,000	Dec. '15	10.00
Copper Range, c.	Mich.	394,001	25	16,744,753	June '16	2.50
Daly Judge, s.l.	Utah.	300,000	1	1,230,000	Apr. '16	0.25
Daly West, s.l.	Utah.	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	Colo.	3,000,000	0.10	84,814	Mar. '10	0.00½
Doe Run, l.	Mo.	65,749	100	3,550,969	Dec. '13	0.76
Eagle & Blue Bell, g.s.l.	Utah.	893,146	1	446,573	Dec. '15	0.05
Elkton Con., g.	Colo.	2,500,000	1	3,579,460	May '15	0.02
El Paso, g.	Colo.	490,000	5	1,707,545	Feb. '14	0.10
Ernestine, g.s.	N.M.	300,000	5	150,000	July '15	0.10
Fed. M. & S., com.	Idaho.	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	Idaho.	120,000	100	12,816,795	June '16	1.00
Florence, g.	Nev.	1,050,000	1	840,000	Apr. '11	0.10
Free Coinage, g.	Colo.	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	258,000	Oct. '14	0.02
Frontier, s.	Wis.	1,250	100	146,202	Nov. '13	2.00
Gemini-Key'ne, l.g.s.	Utah.	5,000	100	2,330,000	June '16	5.00
Gold Chain, g.	Utah.	1,000,000	1	130,000	May '13	0.03
Gold Dollar Con.	Colo.	2,500,000	0.10	100,000	Dec. '12	0.00½
Gold King Con., g.	Colo.	1,000,000	1	1,417,319	Nov. '15	0.01
Golden Cycle, g.	Colo.	1,500,000	1	4,350,000	June '16	0.02
Golden Star, g.	Ariz.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev.	3,559,148	10	28,999,832	Oct. '15	0.10
Grand Central, g.	Utah.	500,000	1	1,633,250	Dec. '15	0.02½
Granite, g.	Colo.	1,650,000	1	286,500	Dec. '12	0.01
Hazel, g.	Cal.	900,000	1	971,000	Dec. '13	0.01
Hecla, l.s.	Idaho.	1,000,000	0.25	4,405,000	June '16	0.15
Hercules, l.s.	Idaho.	1,000,000	1	12,150,000	June '16	0.30
Homestake, g.	S. D.	251,160	100	39,871,432	June '16	0.65
Horn Silver, l.s.z.	Utah.	400,000	25	5,682,000	June '16	0.05
Inspiration, c.	Ariz.	1,159,471	20	1,449,339	May '16	1.25
Iowa, g.s.l.	Colo.	1,666,667	1	270,167	Dec. '15	0.00½
Iowa-Tiger, g.s.	Colo.	3,000	1	25,179	Dec. '15	1.00
Iron Blossom, s.l.g.	Utah.	1,000,000	0.10	2,650,000	Apr. '16	0.10
Iron Silver, s.l.g.	Colo.	500,000	20	4,950,000	Dec. '14	0.10
Jamison, g.	Cal.	390,000	10	386,100	Dec. '15	0.01
Jerry Johnson, g.	Colo.	2,500,000	0.10	187,500	Nov. '14	0.01
Kendall, g.	Mont.	500,000	5	1,555,000	Apr. '16	0.10
Kennecott Cop., c.	Alas.	2,780,583	....	6,950,974	June '16	1.50
Kennedy, g.	Cal.	100,000	100	1,831,001	Apr. '10	0.03
Klar Piquette, s.l.	Wis.	20,000	1	259,000	Apr. '13	0.50
Knob Hill, g.	Wash.	1,000,000	1	70,000	Oct. '13	0.00½
Liberty Bell, g.	Colo.	133,551	5	1,752,795	Sept. '15	0.20
Little Bell, l.s.	Utah.	300,000	1	90 000	Apr. '16	0.05
Magma, c.	Ariz.	240,000	5	480,000	June '16	0.50
Mammoth, g.s.c.	Utah.	400,000	2.50	2,360,000	June '16	0.05
Mary McKinney, g.	Colo.	1,309,252	1	1,169,308	July '14	0.02
May Day, g.s.l.	Utah.	800,000	0.25	284,000	May '16	0.02
Mexican, g.s.	Nev.	201,600	2.50	161,910	June '14	0.75
Miami, c.	Ariz.	747,114	5	7,454,441	May '16	1.50
Modoc, g.s.	Colo.	500,000	1	275,000	Dec. '11	0.01
Mohawk, c.	Mich.	100,000	25	4,275,000	Feb. '16	7.00
Monarch-Mad'a, g.s.l.	Colo.	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	488,588	Dec. '12	0.10
Mountain, c.	Cal.	250,000	25	4,216,250	May '08	0.44
National, g.	Nev.	750,000	1	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,999,457	5	22,475,480	June '16	0.75
New Century, s.l.	Mo.	330,000	1	237,600	Oct. '09	0.01
New Idria, q.	Cal.	100,000	5	2,030,000	June '16	1.00
North Butte, c.	Mont.	430,000	15	12,922,000	Apr. '16	0.50
North Star, g.	Cal.	250,000	10	4,912,040	June '16	0.30
Old Domin'n, M. & Sm.	Ariz.	162,000	25	7,371,000	June '16	3.00
Ophir, s.g.	Nev.	201,600	3	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah.	898,978	0.25	80,907	Jan. '13	0.02
Oroville Dredging	Cal.	686,498	5	2,034,936	June '16	0.12
Osceola, c.	Mich.	96,150	25	13,621,925	Apr. '16	4.00
Parrot, c.	Mont.	229,850	10	7,871,839	July '15	1.63
Pearl Con., g.	Wash.	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	87,500	Feb. '10	0.00½
Pioneer, g.	Alas.	5,000,000	1	2,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Ida.	809,407	1	217,083	Apr. '13	0.04
Pittsburg Silver Peak, g.	Nev.	2,790,000	1	771,200	July '14	0.02
Portland, g.	Colo.	3,000,000	1	10,357,080	Apr. '16	0.03
Quilp	Wash.	1,500,000	1	67,500	Feb. '12	0.01

Corrected to July 1, 1916.

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt.
Quincy, c.	Mich.	110,000	$ 25	$22,547,500	June '16	$4.00
Ray, c.	Ariz.	1,571,279	10	6,695,913	June '16	0.50
Reorg. Booth, g.	Nev.	1,000,000	1	400,000	June '16	0.05
Republic, g.	Wash.	1,000,000	1	170,000	Nov. '12	0.01½
Rochester, l.z.	Mo.	4,900	100	190,846	July '12	0.50
Round Mountain, g.	Nev.	1,266,591	1	363,365	Aug. '13	0.04
Seven Troughs Coal., g.	Nev.	1,443,077	1	246,419	Apr. '16	0.02½
St. Joseph, l.	Mo.	1,409,466	10	10,902,113	June '16	0.25
Shannon, c.	Ariz.	300,000	10	750,000	Jan. '13	0.50
Shattuck Arizona, c.	Ariz.	350,000	10	3,762,500	Apr. '16	1.25
Silver King Coal., l.s.	Utah.	1,250,000	5	13,960,885	Apr. '16	0.15
Silver King Con., l.s.	Utah.	637,582	1	878,615	Apr. '16	0.10
Sioux Con., s.l.g.	Utah.	745,389	1	872,097	July '11	0.04
Skidoo, g.	Cal.	1,000,000	5	365,000	Oct. '14	0.01
Snowstorm, c.g.	Ida.	1,500,000	1	1,192,103	Oct. '13	0.02
South Eureka, g.	Calif.	299,981	1	722,870	May '16	0.07
Standard Con., g.s.	Cal.	178,394	10	5,274,407	Nov. '13	0.25
Stewart, s.l.	Ida.	1,238,362	1	2,012,314	Dec. '15	0.05
Stratton's Ind., g.	Colo.	1,000,000	0.60	618,625	Jan. '16	0.04
Success, s.	Ida.	1,500,000	1	1,380,000	June '16	0.03
Superior & Pitts., c.	Ariz.	1,499,792	10	10,318,569	Dec. '15	0.38
Tennessee, c.	Tenn.	200,000	25	5,206,250	Apr. '16	0.75
Tomboy, g.s.	Colo.	310,000	4.85	3,860,055	June '16	0.24
Tom Reed, g.	Ariz.	909,555	1	2,528,648	Oct. '15	0.01
Tonopah Belm't, s.g.	Nev.	1,500,000	1	8,018,027	Apr. '16	0.12½
Tonopah Ext., g.s.	Nev.	1,272,801	1	1,209,907	Apr. '16	0.10
Tonopah of Nev., s.g.	Nev.	1,000,000	1	13,300,000	Apr. '16	0.15
Trimountain, c.	Mich.	100,000	25	1,450,000	Dec. '13	2.00
Tuolumne, c.	Mont.	2,500,000	1	520,000	May '13	0.10
Uncle Sam, g.s.l.	Utah.	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c.	Wash.	1,000,000	1	40,000	Nov. '12	0.01
United (Crip. Ck.) g.	Colo.	4,000,100	1	440,435	Jan. '10	0.04
United Globe, c.	Ariz.	23,000	100	3,335,000	June '16	18.00
United Verde, c.	Ariz.	300,000	100	38,197,000	June '16	1.50
Utah, s.l.	Utah.	100,000	10	281,860	Dec. '10	0.02
Utah, c.	Utah.	1,624,490	10	41,656,592	June '16	3.00
Utah Con., c.	Utah.	300,000	5	9,600,000	June '16	0.75
Valley View, g.	Colo.	1,000,000	1	240,000	Dec. '10	0.04
Victoria, g.s.l.	Utah.	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo	1,500,000	1	3,352,500	Apr. '16	0.03
Wasp No. 2, g.	S. D.	500,000	1	649,466	May '16	0.02½
Wellington Mines, g.	Colo.	10,000,000	1	650,000	Nov. '15	0.02
Wolverine, c.	Mich	60,000	25	8,880,000	Apr. '16	6.00
Yak, s.l.	Colo.	1,000,000	1	2,127,685	June '16	0.07
Yankee Con., g.s.	Utah.	1,000,000	1	167,500	Jan. '13	0.01
Yellow Aster, g.	Cal.	100,000	10	1,185,789	June '16	0.12
Yellow Pine, l.z.s.	Nev.	1,000,000	1	1,393,008	June '16	0.15
Yukon Gold, g.	Alas.	3,500,000	5	8,108,110	June '16	0.07½

Iron, Industrial and Holding Companies

Am. Sm. & Ref., com	U. S.	501,080	100	$30,586,033	June '16	$1.50
Am. Sm. & Ref., pf.	U. S.	500,000	100	56,546,386	June '16	1.75
Am. Smelters, pf. A.	U. S.	170,000	100	11,289,944	Apr. '16	1.50
Am. Smelters, pf. B.	U. S.	300,000	100	16,250,000	Apr. '16	1.25
Greene Cananea	U. S.	486,209	100	4,344,064	Feb. '16	1.00
Guggenheim Expl.	U. S.	833,732	25	34,036,783	Apr. '16	11.85
Inter'l Nickel, com.	U. S.	1,673,384	25	30,941,338	June '16	2.00
Inter'l Nickel, pfd.	U. S.	89,126	100	5,614,824	May '16	1.50
National Lead, com.	N. Y.	206,554	100	9,448,662	June '16	1.00
National Lead, pf.	N. Y.	243,676	100	32,206,118	June '16	1.75
Old Dominion, c.	Ariz.	293,353	25	8,333,919	June '16	3.00
Phelps, Dodge & Co.	U. S.	450,000	100	51,059,304	June '16	6.00
U. S. Steel Corp., com.	U. S.	5,083,025	100	235,068,001	June '16	1.25
U. S. Steel Corp., pf.	U. S.	3,602,811	100	408,122,852	May '16	1.75
U. S. S., R. & M., com.	U.S.-Mex.	351,115	50	6,976,794	Apr. '16	1.00
U. S. S., R. & M., pf.	U.S.-Mex.	486 350	50	17,646,805	Apr. '16	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 212,500	Oct. '12	$0.25
Amparo, g.s.	Mex.	2,000,000	1	1,860,883	May '16	0.05
B. C. Copper	B. C.	591,709	5	615,198	Jan. '13	0.15
Beaver Con., s.	Ont.	2,000,000	1	649,912	Apr. '16	0.03
Buffalo, s.	Ont.	1,000,000	1	2,787,000	July '14	0.05
Canadian Goldfields, g.	B. C.	600,000	0.10	290,000	July '14	0.001½
Chontalpan, g.s.l.z.	Mex.	7,000	25	61,250	May '14	0.75
Cobalt Townsite, s.	Ont.	45,000	1	1,042,259	May '14	0.10
Coniagas, s.	Ont.	800,000	5	8,040,000	Feb. '16	0.25
Con. M. & S. Co. of Can	B. C.	337,100	25	2,529,966	Apr. '16	2.50
Crown Reserve, s.	Ont.	1,999,957	1	6,102 408	July '15	0.02
Dome Mines, s.	Ont.	400,000	10	800,000	June '16	0.50
Dos Estrellas, g.s.	Mex.	300,000	0.50	10,335,000	Dec. '13	1.50
El Oro, g.s.	Mex.	1,147,500	4.85	8,947,260	July '13	0.24
Esperanza, s.g.	Mex.	455,000	4.85	12,013,882	July '15	0.24
Granby, s.l.c.	B.C.	149,985	100	6,275,319	May '16	1.50
Greene Con., c.	Mex.	1,000,000	10	12,044,400	May '16	1.00
Guanajuato D., pf., s.	Mex.	10,000	1000	214,356	Jan. '10	3.00
Hedley Gold	B. C.	120,000	10	1,343,520	June '16	0.50
Hollinger, g.	Ont.	600,000	5	4,890,000	June '16	0.20
Kerr Lake, s.	Ont.	600,000	5	6,420,000	June '16	0.25
La Rose Con., s.	Ont.	1,498,627	5	5,536,983	Apr. '16	0.05
Le Roi No. 2, g.	B. C.	120,000	24.30	1,566,450	Mar. '16	0.30
Lucky Tiger Com., g.	Mex.	715,337	10	3,470,839	June '16	0.08
McK.-Dar. Sav. s.	Ont.	2,247,692	1	4,675,194	Apr. '16	0.03
Mines Co. of An. (new)	Mex.	862,658	10	4,958,600	July '13	0.12½
N. Y. & Hond. Ros., g.	C. A.	200,000	10	3.990 000	Apr. '16	0.50
Nipissing, s.	Ont.	1,200,000	5	14,040,000	Apr. '16	0.25
Peñoles, s.l.g.	Mex.	80,000	25	6,361,688	June '13	1.25
Pinguico, pf., s.	Mex.	20,000	100	840,000	Oct. '13	3.00
Right of Way Mns, s.	Ont.	1,685,500	1	712,309	June '16	0.05
Rio Plata, s.	Mex.	374,518	5	345,745	Feb. '13	0.05
San Rafael, g.s.	Mex.	2,400	25	1,442,380	Jan. '14	0.50
San Toy, g.s.	Mex.	5,750,000	1	530,000	July '13	0.01
Seneca-Superior	Ont.	478,884	1	1,316,431	June '16	0.30
Sorpress, g.s.	Mex.	19,200	20	3,979,240	Jan. '11	34.00
Stand'd Silver-Lead	B. C.	2,000,000	1	2,100,000	June '16	0.02½
Temiskaming, s.	Ont.	2,500,000	1	1,534,156	Mar. '16	0.03
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,940,250	Nov. '14	3.00
Trethewey, s.	Ont.	1,000,000	1	1,061,998	July '14	0.05
Wettlaufer-Lorrain, s.	Ont.	1,416,590	1	637,465	Oct. '13	0.05

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont.	June 15	July 15	$0.005
Algomah, Mich.	May 18	.....	1.00
Blue Bell, Ida.	July 8	Aug. 5	0.002
Bullion, Ida.	July 10	July 31	0.01
Cedar Creek, Ida.	July 5	Aug. 5	0.01
Central Eureka, Calif.	June 16	July 14	0.05
Challenge, Nev.	June 12	July 7	0.05
Columbus Ext., Utah	July 13	Aug. 8	0.02
Confidence, Nev.	June 23	July 14	0.10
Cons. Imperial, Nev.	July 18	Aug. 10	0.01
Crackerjack, Nev.	July 3	Aug. 1	0.01
Emerald, Utah	June 15	July 8	0.0033
Fortuna, Utah	June 15	July 8	0.005
Friend, Ida.	June 30	July 20	0.002
Giant, Ida.	June 16	July 17	0.003
Goldstrike Bon., Utah	June 15	July 15	0.01
Gold Mt. Champion, Utah	July 20	Aug. 10	0.0025
Gould & Curry, Nev.	July 14	Aug. 3	0.03
Hope, Calif.	July 17	Aug. 14	0.01
Imperial, Ida.	June 12	July 12	0.005
Independence, Ida.	July 8	July 29	0.001
Laclede, Ida.	July 3	July 25	0.003
Leonora, Utah	June 20	July 11	0.005
National, Ida.	June 2	July 3	0.02
Nevada-Douglas, Nev.	July 15	Aug. 16	0.10
North Franklin, Ida.	June 19	July 8	0.005
North Lake, Mich.	June 14	.....	1.00
Old Veteran, Ida.	July 8	Aug. 5	0.002
Ophir, Nev.	June 13	July 6	0.05
Rio Grande, Nev.	June 22	July 22	0.002
Rob Roy, Ida.	June 10	July 10	0.002
Rockford, Ida.	June 30	July 21	0.002
Sierra Nevada, Nev.	July 11	Aug. 3	0.10
Silver Moon, Ida.	July 8	Aug. 3	0.005
Silver Pick, Nev.	July 5	Aug. 14	0.01
Spearhead Reor., Nev.	July 3	Aug. 3	0.01
Swansea Ext., Utah	July 10	Aug. 1	0.0025
Tintic Central, Utah	July 12	Aug. 8	0.005
Ton. Gypsy Queen, Nev.	July 11	Aug. 15	0.01
Uvada, Nev.	June 24	July 27	0.02
Wallace, Ida.	June 29	July 29	0.0025
Wasatch-Utah, Utah	June 19	July 22	0.0025
Wisconsin North Fork, Calif.	June 12	July 10	0.01

Stock Quotations

SAN FRANCISCO June 30	
Name of Comp.	Bid.
Alta	.05
Andes	.10
Best & Belcher	.06
Bullion	‡.03
Caledonia	.44
Challenge Con.	.10
Confidence	.18
Cons. Imperial	.01
Con. Virginia	.11
Gould & Curry	.02
Hale & Norcross	.08
Jacket-Cr. Pt.	.04
Mexican	.16
Occidental	.70
Ophir	.31
Overman	.06
Savage	.07
Seg Belcher	.02
Sierra Nevada	.23
Union Con.	.76
Utah Con.	.02
Belmont	4.00
Jim Butler	.95
MacNamara	.05
Midway	.22
Mont.-Tonopah	.25
North Star	.16
Rescue Eula	.34
West End Con.	.92
Atlanta	.10
Blue Bell	.01
Booth	.15
C.O.D. Con	.03
Comb. Frac	.07
D'field B.B.	.02
D'field Daisy	.02
Jumbo Extension	.78
Pitts.-Silver Peak	.09
Round Mountain	.61
Sandstorm Kendall	.03
Silver Pick	.09
Central Eureka	.10
Argo	.15
Big Jim	.81
Lazy Boy	.13
Oatman Cres.	‡.42
Oatman No. Star	.17
Tom Reed	1.45
United Eastern	3.68¾
United Western	.12

LONDON	June 19
Alaska Tre'dwell	£6 5s 0d
Burma Corp.	2 14 4½
Cam & Motor	0 15 0
Camp Bird	0 9 6
El Oro	0 10 0
Esperanza	0 11 6
Mexico Mines	4 2 6
Nechi, pfd.	0 13 6
Oroville	0 16 0
Santa Gert'dis.	0 14 3
Tomboy	1 3 0

SALT LAKE July 1	
Name of Comp.	Bid.
Alta Con.	.42
Black Jack	.05
Colorado Mining	.17
Crown Point	.04½
Daly-Judge	7.10
Emma Cop.	.43
Gold Chain	.25
Grand Central	.69
Iron Blossom	1.65
Lower Mammoth	.04
May Day	.12½
Opohongo	‡.01½
Prince Con.	1.32½
Seven Troughs	‡.02½
Silver King Coal'n	2.67½
Silver King Con.	3.10
Sioux Con.	.13½
Uncle Sam	.06
Yankee	‡.20½

COLO. SPRINGS June 30	
Acacia	‡.03½
Doctor Jack Pot	.09½
Elkton Con.	.15
El Paso	.78
Findlay	.03
Gold Sovereign	.03½
Golden Cycle	2.12½
Granite	.64
Isabella	.17
Jack Pot	.05
Jerry Johnson	‡.04
Mary McKinney	.37
Portland	1.50
Vindicator	2.29

TORONTO July 1	
Adanac	1.37½
Bailey	.07
Chambers Ferland	.22
Coniagas	4.87½
La Rose	.61
Peterson Lake	.24
Right of Way	.05
Seneca Superior	.36
T. & Hudson Bay	50.00
Temiskaming	.60
Trethewey	.21
Wettlaufer-Lor.	.20
Dome Exten.	.36
Dome Lake	.31
Foley O'Brien	.50
Hollinger	29.75
Imperial	‡.03
Jupiter	.31
McIntyre	1.59
Porcu. Crown	.88
Preston E. D.	.03
Vipond	.54
West Dome	.37

N. Y. EXCH. July 3	
Name of Comp.	Clg.
Alaska Gold M.	18
Alaska Juneau	8
Am.Sm.&Ref.,com	94½
Am. Sm. & Ref., pf.	111
Am. Sm. Sec., pf. A	92
Am. Sm. Sec., pf. B.	83½
Am. Zinc	37½
Am. Zinc, pf.	65½
Anaconda	82¾
Batopilas Min.	1¼
Bethlehem Steel	425
Bethlehem Steel, pf.	130
Butte & Superior	67
Chile Cop.	21½
Chino	50½
Colo. Fuel & Iron	42
Crucible Steel	71½
Dome Mines	26
Federal M. & S.	12½
Federal M. & S., pf.	36½
Great Nor., ore ctf.	34¾
Greene Cananea	41½
Homestake	130
Inspiration Con.	50
International Nickel	47½
Kennecott	49
Lackawanna Steel	‡66
Miami Copper	35½
Nat'l Lead, com.	65
National Lead, pf.	113
Nev. Consol.	16½
Ontario Min.	6¾
Quicksilver	2¾
Quicksilver, pf.	5
Ray Con.	22½
Republic I&S, com.	45
Republic I&S, pf.	107½
Sloss-Sheffield	46
Sloss-Sheffield, pf.	94
Tennessee Copper	35½
Utah Copper	78
U. S. Steel, com.	86¼
U. S. Steel, pf.	117½
Va. Iron C. & C.	46

N. Y. CURB July 3	
Beaver Con.	.39
Buffalo Mines	1
Butte & N. Y.	1½
Butte C. & Z.	5½
Can. Cop. Corpn.	1¾
Cashboy	.05
Cerro de Pasco	34
Con. Ariz. Sm.	1 7/16
Con. Coppermines	2½
Con. Nev.-Utah	.28¾
Crystal Cop.	1
First Nat. Cop.	3¾
Florence	.35
Goldfield Con.	.83
Goldfield Merger	.08½
Granite	.30
Hecla Min.	5¾
Howe Sound	4½
Jerome Verde	1¾
Joplin Ore & Spel.	3
Kenefick Zinc	‡13½
Kerr Lake	4
Magma	14
Majestic	.75
McKinley-Dar-Sa.	.50
Mother Lode	.29
Nevada Hills	.17
N. Y. & Hond.	15¾
Nipissing Mines	7
Oro	‡.05
Ray Hercules	3¾
Rochester Mines	.58
St. Joseph Lead	15½
Standard S. L.	1½
Stewart	7/32
Success	.87
Tonopah	5¾
Tonopah Ex.	5¾
Tribullion	.31½
United Zinc	8½
White Knob, pf.	‡1½
Yukon Gold	2 7/16

BOSTON EXCH July 3	
Name of Comp.	Bid
Adventure	2½
Ahmeek	95
Algomah	1½
Allouez	64½
Ariz. Com., ctfs.	9
Bonanza	.25
Butte-Ballaklava	2
Calumet & Ariz.	67½
Calumet & Hecla	530
Centennial	15½
Copper Range	59½
Daly West	2¾
East Butte	12¾
Franklin	6¼
Granby	85
Hancock	12½
Helvetia	.25
Indiana	2½
Island Cr'k, com.	46½
Island Cr'k, pfd.	88½
Isle Royale	27
Keweenaw	3¾
Lake	12
La Salle	1
Mason Valley	2½
Mass.	11½
Mayflower	1¾
Michigan	3
Mohawk	98½
New Arcadian	6
New Idria	12
North Butte	22½
North Lake	1½
Ojibway	1¼
Old Colony	1¾
Old Dominion	65
Osceola	85
Quincy	86
St. Mary's M. L.	74¾
Santa Fe	1¾
Shannon	8
Shattuck-Ariz.	28
So. Lake	5½
So. Utah	.15
Superior	14½
Superior & Bost.	3¾
Tamarack	41
Trinity	4¾
Tuolumne	.40
U. S. Smelting	68½
U. S. Smelt'g, pf.	50½
Utah Apex	4½
Utah Con.	12¾
Utah Metal	8½
Victoria	3
Winona	5
Wolverine	53
Wyandot	1¾

BOSTON CURB July 3	
Bingham Mines	10½
Boston Ely	.89
Boston & Mont.	1 1/16
Butte & Lon'n Dev.	.68
Calaveras	5
Calumet-Corbin	.03½
Chief Con.	1 1/16
Cortez	.30
Crown Reserve	.51
Davis-Daly	1¾
Eagle & Blue Bell	1¾
Houghton Copper	1½
Iron Cap Cop., pf.	6
Mexican Metals	.30
Mines of America	2¾
Mojave Tungsten	6
Nat. Zinc & Lead	1 1/16
Nevada-Douglas	.95
New Baltic	1¾
New Cornelia	12
Ohio Copper	.10
Oneco	1
Raven Copper	‡.18
Rex Cons.	.14
Rilla	.29
United Verde Ext.	27½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	65.024	25.948	23.267	31.060
July	54.678	47.519	.....	25.219	22.597	.....
August	54.344	47.163	.....	25.979	22.780	.....
September	53.290	48.680	.....	24.260	23.591	.....
October	50.654	49.385	.....	23.199	23.925	.....
November	49.082	51.714	.....	22.703	25.094	.....
December	49.375	54.971	.....	22.900	26.373	.....
Year	54.811	49.684	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York		London			
	Electrolytic		Standard		Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	26.601	82.574	112.432	95.333	137.455
July	18.796	.....	76.011	.....	91.409	.....
Aug.	16.941	.....	68.673	.....	82.333	.....
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	42.231	167.636	179.466
July	37.423	.....	167.080	.....
August	34.389	.....	151.440	.....
September	33.125	.....	152.625	.....
October	33.080	.....	151.554	.....
November	39.224	.....	167.670	.....
December	38.779	.....	167.000	.....
Av. year	38.590	.....	163.960	.....

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.655	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	6.936	5.836	6.749	25.170	31.011
July	5.659	.....	5.531	.....	24.611	.....
August	4.656	.....	4.520	.....	21.946	.....
September	4.610	.....	4.490	.....	23.151	.....
October	4.600	.....	4.499	.....	23.994	.....
November	5.155	.....	5.078	.....	26.278	.....
December	5.355	.....	5.266	.....	28.807	.....
Year	4.673	.....	4.567	.....	22.917	.....

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	11.752	21.038	11.582	100.614	68.591
July	19.026	.....	18.856	.....	97.250	.....
Aug.	12.781	.....	12.611	.....	67.786	.....
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Besemer‡		Basic‡		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	21.95	13.67	18.95	13.77	19.34
July	14.94	.....	13.91	.....	13.68	.....
August	16.01	.....	15.31	.....	14.75	.....
September	16.86	.....	15.95	.....	15.70	.....
October	16.95	.....	15.96	.....	15.80	.....
November	17.57	.....	16.47	.....	17.20	.....
December	19.97	.....	18.44	.....	18.95	.....
Year	$15.82	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.